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For related information see also *Astronautics*.

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85 URBAN TECHNOLOGY AND TRANSPORTATION 264
Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.
For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

SPACE SCIENCES

Includes space sciences (general); astronomy; astrophysics; lunar and planetary exploration; solar physics; and space radiation.
For related information see also *Geosciences*.

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89 ASTRONOMY 265
Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

90 ASTROPHYSICS 266
Includes cosmology; and interstellar and interplanetary gases and dust.

91 LUNAR AND PLANETARY EXPLORATION 267
Includes planetology; and manned and unmanned flights.
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92 SOLAR PHYSICS 268
Includes solar activity, solar flares, solar radiation and sunspots.

93 SPACE RADIATION 268
Includes cosmic radiation; and inner and outer earth's radiation belts.
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GENERAL

99 GENERAL N.A.

Note: N.A. means that no abstracts were assigned to this category for this issue.

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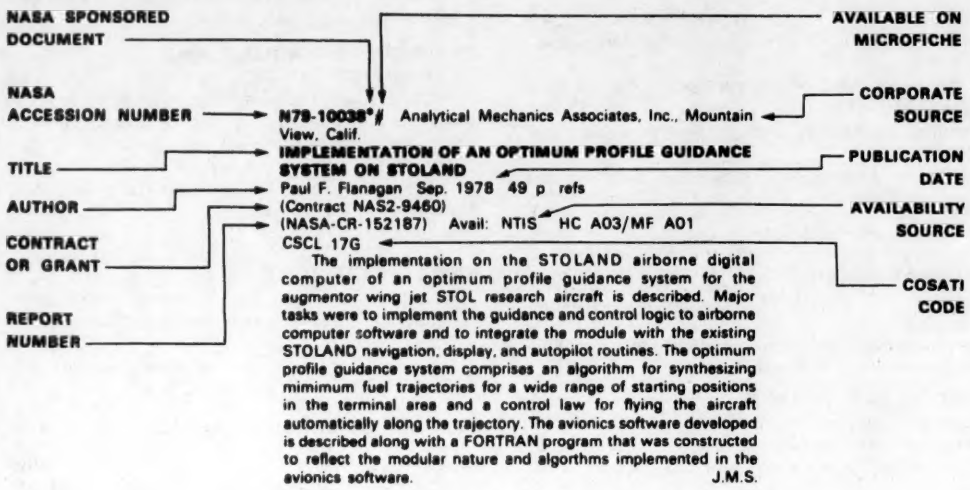
TYPICAL CITATION AND ABSTRACT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N79-10038*# Analytical Mechanics Associates, Inc., Mountain View, Calif.
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TITLE
IMPLEMENTATION OF AN OPTIMUM PROFILE GUIDANCE SYSTEM ON STOLAND
PUBLICATION DATE
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The implementation on the STOLAND airborne digital computer of an optimum profile guidance system for the augmentor wing jet STOL research aircraft is described. Major tasks were to implement the guidance and control logic to airborne computer software and to integrate the module with the existing STOLAND navigation, display, and autopilot routines. The optimum profile guidance system comprises an algorithm for synthesizing mimimum fuel trajectories for a wide range of starting positions in the terminal area and a control law for flying the aircraft automatically along the trajectory. The avionics software developed is described along with a FORTRAN program that was constructed to reflect the modular nature and algorithms implemented in the avionics software. J.M.S.

ON-GOING RESEARCH PROJECTS

This is a listing of research projects— not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research and Support Facilities (air). For Related Information See Also Astronautics.

1.0001, SELF-SUFFICIENT SECONDARY POWER AND STARTING SYSTEM

P. WOOD, Signal Companies Incorporated, Airesearch Mfg Co of Arizona, *402 S. 36th St., Phoenix, Arizona* 85034 (DN796820; N00140-76-C-0206)

Provide for optimum designs of a self-sufficient secondary power and starting system (SSSPS) of minimum weight and volume. The system will make advanced Navy high-performance aircraft completely independent of ground support equipment for engine starting and aircraft pre-flight checkout/standby operation and will also provide emergency in-flight power for high-altitude aircraft control and engine starting.

This program will be a 24 month effort to perform studies and analyses leading to definition of optimum secondary power system. Both near-term and far-term aircraft requriements are to be considered. The final product of this program shall be a technical report detailing candidate SSSPS designs and associated R/D tasks necessary to develop and demonstrate the selected design.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

1.0002, MULTI-YEAR TASK CONTRACT FOR AEROSAT SYSTEMS

UNKNOWN, Aerospace Corporation, *P.O. Box 92957, Los Angeles, California* 90009 (FA77WA-3861; FA160311 (TRAIS NO.))

The total Systems Engineering Support efforts with which this contract is associated will encompass a variety of detailed tasks and extend over a period of years. A general list of expected tasks are as follows: Task 1. Development of National Plan; Task 2. Aerosat Program Implementation Plan; Task 3. System Engineering Support for Aerosat Program; Task 4. U.S. Aerosat System Integration; Task 5. International System Interfaces and Space Segment Integration; and Task 6. Operational System Planning and Analysis.

SUPPORTED BY U.S. Dept. of Transportation, Federal Aviation Admin.

1.0003, CONTROL THEORY FOR FLEXIBLE FLIGHT VEHICLES

A.V. BALAKRISHNAN, Optimization Software Inc., *Los Angeles, California* 90024 (DN775232; N00014-77-C-0195)

Vibrations of flight vehicles and vehicle parts (such as wings, fins, etc.) interfere with performance. The objective of this task is to see if recent developments in the area of control of distributed parameter systems can contribute to the problem of vibration reduction.

A meeting will be organized and conducted to bring together control researchers and engineers concerned with flight vehicle vibration problems. There will be great emphasis on discussion, with very few formal talks so that an understanding of what the problems are and whether or not they are amenable to recent research results can be developed.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

1.0004, IMPACT OF ALTERNATE FUELS ON AIRCRAFT CONFIGURATION CHARACTERISTICS

D.A. ROBINSON, Rockwell International Corp., *International Airport, Los Angeles, California* 90009 (DF140500; F33615-77-C-3155)

Primary effort in the past has focused on fuel conservation through improving propulsion efficiency, drag reduction and use of different petroleum based fuels. These studies fall under the category of near-term measures. The recent fuel crisis has emphasized the fact that nature's resources are limited. Over half the military energy consumption is in the form of aviation fuel, hence an examination of the use of fuels other than conventional hydrocarbons is needed. Therefore, the objective of this study is to indicate the effects of alternate fuels on aircraft configurations for several typical base line missions as a first step to identify the most promising alternatives.

The contractor shall conduct an analytical investigation of the impact of alternate fuels on fighter and bomber type aircraft configuration characteristics. Typical missions (air superiority, strategic strike, area intercept) will be used to evaluate performance characteristics of conceptual and modified aircraft designs using the most promising alternate fuels.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0005, SAW READOUT

J.P. RAHN, U.S. Navy, Weapons Center, *Ridgecrest, California* 93555 (DN782271)

To carry out a program which will lead to the development of an infrared imaging system that is read out by means of surface acoustic waves. Such a system could operate in either the 3-5 micron or 8-14 micron bands and would have many desirable features that are nonexistent in present systems, e.g., low cost, compact, rugged, no moving parts and room temperature performance may be possible.

The electric field of a surface acoustic wave propagating on a piezoelectric material (such as lithium niobate) penetrates into an adjacent semiconductor and experiences attenuation and phase shift due to the presence of free charge carriers in the latter. This effect will be utilized to sense spatial variations in infrared intensity on either a narrow bandgap semiconductor or a pyroelectric material. Measurements will be made that will result in a definitive statement of the applicability of surface acoustic wave scanning of infrared imagery to the needs of the Navy. It is anticipated that industry involvement in this program will begin during fy78.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0006, EVALUATION OF EXPLOSAFE

A. SZEGO, Canadian Commercial Corp., *Ottawa, Ontario, Canada* (DF460700; F33615-77-C-3115)

Evaluation of an advanced explosion suppression material called 'explosafe' for use in aircraft fuel tanks.

The program is structured into two major phases. Phase I consists of initial material qualification testing by the contractor to determine the feasibility of installing explosafe in aircraft fuel tanks. Phase II consists of the USAF evaluating the explosion suppression performance of explosafe.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0007, HIGH-SPEED CYLINDRICAL ROLLER BEARING DEVELOPMENT

L. DOBEK, United Technologies Corp., *P.O. Box 2691, West Palm Beach, Florida* 33402 (DF461730; F33615-77-C-3114)

Extend the state-of-the-art of turbine engine cylindrical roller bearing technology to 3 million dn capability.

Roller bearings will be designed using bearing parameters that have been identified as most important in an existing Navy/Air Force cooperative program with United Technologies, Pratt-Whitney Aircraft Div. Bearings will be fabricated and tested up to 3 million dn. Parameters will be modified and analytical programs will be changed as required to assure a 3 million dn design capability for turbine engine mainshaft roller bearings.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

1.0008, DEVELOPMENT OF BERYLLIUM-TITANIUM COMPOSITE FAN BLADES FOR NAVAL AIRCRAFT ENGINES

M. HERMAN, General Motors Corporation, Detroit Disel Allison Div, *4700 W. 10th St., Indianapolis, Indiana* 46206 (DN590036; N00019-75-C-0264)

Develop improved beryllium/titanium composite extrusions by optimizing process variables and obtain the design criteria for prototype fan and compressor blades.

Develop and evaluate a process to integrally forge a root attachment on the end of extruding beryllium/titanium composite blade forgings.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0009, SELF-CONTAINED CARTRIDGE FOR ADVANCED EJECTOR SYSTEMS

W.P. PECK, U.S. Navy, Ordnance Station, *Indian Head, Maryland* 20640 (DN896203)

To investigate self-contained cartridge concepts and apply the resulting technology to advanced ejector systems. The objective is to decrease stores release/ejection equipment maintenance and thus reduce aircraft turn-around time and increase aircraft operational readiness.

A self-contained cartridge design will be investigated which will encapsulate all propellant combustion products. This will provide a totally clean power source for stores release/ejection equipment. The cartridges will be tested in a breadboard ejector system. During FY 78 a telescoping cartridge case design will be investigated. Materials will be evaluated for adaptability to deep drawing techniques and the high stress/fatigue encountered during operation. Effort in FY 79 will include finalizing telescoping case design concepts based upon FY 78 initial feasibility testing, and investigating propellant formulations which will meet self-contained cartridge performance requirements. New/modified propellant compositions will be evaluated to attain the formation of a high percentage of condensables upon functioning to result in low residual internal cartridge pressure. In FY 80, self-contained cartridge and propellant designs will be optimized and the design feasibility testing program conducted.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0010, DIGITAL FLIGHT CONTROL SYSTEM ADVANCED TECHNIQUES EVALUATION

D.G. BAILEY, Honeywell Incorporated, *2600 Ridgeway Pkwy. N.E., Minneapolis, Minnesota* 55413 (DF140040; F33615-77-C-2070)

Advanced high-performance aircraft will be dependent on sophisticated flight controls integrated with other avionics for mission success. Improved survivability of the flight controls against combat damage, equipment failure, and electrical hazards will be required. advanced digital techniques have the potential for satisfying these requirements but lack the necessary flight test verification that flight control system quality and integrity will not be impacted. The objective of this effort is to flight-test and demonstrate the feasibility of refinements to multimode control laws, analytic redundancy, area multiplexing, and fiber optic data links. This effort will reduce the technical risk and increase the confidence that these advanced digital techniques do not compromise flight control system performance and safety. It will also demonstrate the improved target tracking achieved through software refinements.

Existing multimode control laws in YA-7D (67-14583) will be refined through software reprogramming to optimize flight path performance during turning maneuvers. Software coding will be developed for fault tolerance through analytical redundancy and tested on the aircraft. A dais type area multiplexing data bus per MIL-STD-1553 will be developed to be compatible with the existing dual HDC-301 computers and flight tested for suitability of performing the flight stabilization and control functions. An optically coupled data bus will be investigated by exchanging the twisted shielded pair transmission lines with a fiber optic cable including optical line drivers and receivers and flight tested. A test program will be conducted to evaluate the potential susceptibility of the multiplexed data bus flight control system to lightning induced voltages. Using the multiplexed data bus, an improved dynamic gun sight will be added to further investigate target tracking capabilities of the multimode control laws.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0011, DEVELOPMENT OF ADVANCED FLIGHT CONTROL ACTUATION SYSTEM CONCEPT FOR NAVAL A/C

R. FUCHT, Bendix Corporation, *Hackensack, New Jersey* 07608 (DN881139; N62269-77-C-0171)

The general objective of this task is to examine the broad spectrum of new flight control actuation concepts with respect to potential advantages and interrelationships with other aircraft systems. The resultant effect of these new concepts will be evaluated against projected aircraft mission and maintenance requirements. Recent advancements in onboard computers, electrical power equipment and solid-state processing components may offer advantages to new aircraft, especially with growing emphasis on combat survivability and simplified squadron maintenance. The specific objective of this effort is to determine how a contractor developed actuation concept can be adapted for aircraft primary flight controls. The unique feature of this concept is the use of two different power mediums (electricity and bleed air) to drive a single actuator. This contract supports work unit ZA601, Agency Accession No. DN681080.

An actuator will be designed to T-2C aircraft rudder specifications. It will be fabricated, lab-tested and flight-demonstrated on a T-2C test bed. Ultimate application is aimed at V/STOL aircraft.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0012, STUDY OF OPERATIONAL FAILURES IN NAVAL AVIONICS

J. BAUER, U.S. Navy, Air Engineering Center, *Lakehurst Naval Air Station, Lakehurst, New Jersey* 08733 (DN796005)

Develop an understanding of the relative contribution to system failure made by parts failures versus other factors (such as noise, coupling or mechanical wear).

This is to be done by performing failure analysis on failed avionic components to obtain an understanding of the causes. This information will be used to specify failure detection and procedures.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0013, NON-INTEGRATED ENGINE DIAGNOSTIC INSTRUMENTATION SYSTEMS
H. MACLAUGHLIN, U.S. Navy, Air Engineering Center, *Lakehurst Naval Air Station, Lakehurst, New Jersey* 08733 (DN696013)

To effectively develop and/or improve ground support equipment (GSE) for testing, diagnosing, and maintaining propulsion systems in existing naval aircraft, thereby: (1) increasing time between overhauls for present day engines. (2) increasing maintenance system effectiveness. (3) decreasing skill levels required for utilization of diagnostic systems and equipment.

Contract for a study and analysis to identify most frequent propulsion system failure modes. Contract for a study of commercial and military engine diagnostic capabilities and techniques. Establish liaison with commercial organizations and military agencies involved in the development of diagnostic techniques and equipment. Develop and apply data handling procedures to allow simplified equipment operation and integral decision-making capability. Develop prototype diagnostic equipment utilizing new technology in data handling and state-of-the art detection and diagnostic techniques.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0014, DEVELOPMENT OF A GAS GENERATOR FOR A SUPERSONIC ETE
S. MOSKOWITZ, Curtiss Wright Corporation, *1 Passaic St., Rutherford, New Jersey* 07075 (DN789764; N00140-76-C-0499)

Demonstrate the basis performance and viability of a gas-generator for a supersonic expendable turbine engine.

Fabricate the major engine components, assemble into gas generator and conduct performance tests of the gas generator to assess the soundness of the basic engine design.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Propulsion Test Center

1.0015, V/STOL PROPULSION FOOTPRINT IMPACT
J.R. OSANI, U.S. Navy, Air Propulsion Test Center, *Trenton, New Jersey* 08641 (DN789757)

To refine and use computer prediction techniques to evaluate airframe and engine contractor V/STOL proposals in the areas of jet-induced forces and moments and ground footprint.

Install existing programs on the computer at Brookhaven National Laboratory using the terminal at NAPTC. Run test cases against wind-tunnel and full-scale data to verify and improve the validity of these prediction techniques. Use the refined program to evaluate contractor V/STOL proposals. A contract will be awarded under a separate work unit plan to provide an independent evaluation of this prediction technique by a university.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0016, NAVTOLAND (NAVY VERTICAL TAKEOFF AND LANDING) CONTROL/DISPLAY CAPABILITY
B. EULRICK, Calspan Corporation, *1422 Genesses Ave., Buffalo, New York* 14221 (DN881384; N62269-77-C-0561)

To analyze the trade-offs between flight control and display complexity for V/STOL shipboard landings, and recommend optimum configurations. This contract supports work unit ZA601, Agency Accession No. DN681080.

Through literature searches and evaluation of flight test data, develop a matrix of feasible and practicable control display configurations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0017, STRUCTURAL INTEGRITY RESEARCH FOR ENGINES AND AIRFRAMES
G.P. SENDECKYJ, U.S. Air Force, Flight Dynamics Lab., *Wright Patt. A.F.B., Dayton, Ohio* 45433 (DF137380)

Damage accumulation in airframe and engine structures can degrade strength and safety of flight of aerospace vehicles. Knowledge of basic structural behavior is necessary for the development of design and analysis methods for life prediction. Specific investigations will be concerned with fatigue and fracture problems of airframe, engine, and advanced composite structures, strength criteria for laminates, and sensitivity of optimized structural components to initial imperfections. Results will lead to improved structural integrity of military aircraft.

To achieve the many faceted objective, efforts will be undertaken in the following areas: (a) sensitivity of optimized structural components to initial imperfections, (b) failure mode analysis, fracture mechanics, and damage tolerance of composite structures, and (c) development of analysis methods and basic data on load spectrum/environment interaction effects of airframe, engine, and advanced composite components.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0018, ADVANCED FIGHTER SIMULATOR LIGHTING ENVIRONMENT STUDIES
J.A. UPHAUS, U.S. Air Force, Flight Dynamics Lab., *Wright Patt. A.F.B., Dayton, Ohio* 45433 (DF141730)

This effort supports the development of advanced multipurpose cockpit displays to be used primarily in fighter aircraft. The current projected use of multipurpose cathode ray tube displays and other solid-state light emitting displays as replacements for conventional fixed format cockpit instruments has generated a need for detailed specifications and design guidelines to insure display legibility over the extreme range of ambient lighting conditions experienced in an aircraft mission. Legibility of heads-up displays with flexible format capability, visibility of warning and caution indicators, and control of cockpit lighting to maintain maximum pilot capability to recognize and track air and ground targets are additional factors which need definitive design guidelines from a lighting systems standpoint. This program involves the development of guidelines to be used for the development of multipurpose displays, display formats, and lighting systems that insure pilot capability to successfully perform fighter mission tasks in future integrated cockpits.

This effort will involve conducting experiments to develop guidelines for insuring legibility of advanced cockpit displays. These experiments will be conducted in a small scale simulator capable of simulating daylight to total darkness lighting conditions experienced in flight. In addition, experiments on the small scale controlled luminance simulator will also provide data needed to formulate detailed design requirements for a crew station design facility (CSDF). This CSDF will provide the capability to dynamically simulate the full range of ambient luminance conditions including air and ground targets and to evaluate the impact of high luminance levels on a crew's ability to acquire and effectively use visual information inside and outside the cockpit.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0019, NAVY STRUCTURAL FRACTURE CONTROL AND SERVICE LIFE MANAGEMENT PROGRAM
S.L. HUANG, U.S. Navy, Air Vehicle Technology Dept., *Warminster, Pennsylvania* 18974 (DN781434)

Technical objective - the objectives of this program are to augment the specifications for designing and accepting naval aircraft structures which will have a high degree of reliability and damage tolerance, and to formulate a new service life management system based on the existence of initial flaws and the technology for determining their rate of growth and the residual strength of structures in which they occur. Fracture mechanics concepts and NDI techniques will be used to quantify inherent and service-induced damage and to evaluate their effect on structural behavior.

Approach - in order to achieve the stated objective of developing highly reliable fracture resistant air vehicle structures, new design and test specifications must be established, and a new overall methodology for service life management must be implemented to insure structural integrity for current and future naval aircraft. A basic philosophical difference exists between this approach and the current procedure in that it is based upon the existence of initial flaws in the structure. An essential starting point,

therefore, is the knowledge of these flaws in terms of their location, size and distribution. These flaws can be inherent material flaws or flaws induced during manufacture.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0020, PROGRAMMABLE REAL-TIME SIMULATION INTERFACE

R.L. JONE, U.S. Navy, Air Development Center, *Warminster, Pennsylvania* 18974 (DN881069)

To explore advanced techniques in the evaluation of functionally defined airborne weapon systems by developing the expertise to implement a programmable generic man-in-the-loop simulator. The simulator is designed to obtain quantitative measurements of system effectiveness as related to system concepts, system performance specifications, and man-machine interface specifications. By researching and developing a programmable hardware interface using microprocessor technology to program control, indicator, and display functions, cost-effectiveness would be optimized. The primary design goal is flexibility. Firmware would accommodate massive changes in a minimum amount of time. The interfacing of manned stations to digital computer systems is an integral part of the development process of Navy simulators. The recent advances in the fields of digital circuitry and information theory are directly applicable to this interfacing task. The knowledge gained through this research project will be of immense value to the V/STOL, VPX and CSD improvement program simulation efforts.

Upon completion of a microprocessing technology survey, design and develop a programmable real-time simulation interface and microcomputer development system. The system design will include the hardware/software flexibility to evaluate weapon system parameters such as radar performance specifications, tactical functions and algorithms, display formats, man-machine control functions, weapon system functional configuration, and weapon (missile) interface functions.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0021, VTX AIRCRAFT CONCEPTS DEVELOPMENT

L.R. KRAVITZ, U.S. Navy, Air Development Center, *Warminster, Pennsylvania* 18974 (DN762114)

To develop and analyze various options to provide a lower-cost alternative for undergraduate pilot training than the present combination of T-2C and TA-4J aircraft.

Determine and analyze operational, mission and aircraft system performance requirements and goals. Perform VTX aircraft system conceptual design studies. Identify development needs and issues. Develop VTX concept options and prepare d.p., analyze high risk areas and develop a plan for resolving issues to meet DSARC requirements.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

1.0022, FLIGHT-TESTING PROJECTS FOR A COMPOSITE AIRCRAFT

W.T. FOWLER, Univ. of Texas, School of Engineering, Aerospace Engin & Engin Mech, *200 W. 21st, Austin, Texas* 78712

DESCRIPTION: Since it is possible that a composite aircraft may be available for research use in the near future, plans for its utilization are currently being made. Due to the unique structural and electromagnetic properties of composite aircraft, many experiments in the structural and electronics areas are under consideration. In addition, due to the extreme smoothness of the finish of composite aircraft, many experimental programs in aerodynamics and performance testing are possible.

The overall objective of the project is to prepare for the acquisition of the composite aircraft, to seek out areas of potential funded research, and to prepare a research management plan to assure a coherent, safe research program involving the composite aircraft.

SUPPORTED BY University of Texas

1.0023, STATE-OF-THE-ART HEL PROTECTIVE MEASURES

B.A. FORCHT, Vought Corporation, Vought Aeronautics, *P.O. Box 5907, Dallas, Texas* 75222 (DN881168; N62269-76-C-0249)

Establish procedures for providing quick response protection for naval aircraft structures against high-energy laser (HEL) damage. This contract supports work unit ZM501, DN 681081.

Establish techniques to harden aircraft structures and identify specific deficiencies in available technology.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0024, V/STOL AIRCRAFT LAUNCH AND RECOVERY MODEL DEVELOPMENT

V.J. WOLKO, Vought Corporation, *P.O. Box 5907, Dallas, Texas* 75222 (DN881371; N62269-77-C-0038)

To develop a computerized model to predict the dyanmic response of piloted V/STOL aircraft in takeoff and landing from small platform ships.

A computer program will be developed which computes the nonlinear propagation of the mean and variance of all model variables as a function of time.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

1.0025, CRITERIA AND CONCEPT FOR IMPROVED UH-1 MAST BUMPING SAFETY MARGIN

L.W. DOOLEY, Bell Helicopter Company, *P.O. Box 482, Fort Worth, Texas* 76101 (DA0E3790; DAAJ02-77-C-0064)

The purpose of the effort is to (1) develop an analytical method of predicting rotor mast loads due to hub/mast contact, (2) validate the analysis through aeroelastic model tests, (3) develop criteria for the design of the mast and a hub restraint mechanism to make contact or structural deformation improbable under typical operational conditions, and (4) develop and demonstrate the characteristics of a hub spring for the UH-1H helicopter.

An existing rotor/pylon hybrid computer analysis will be modified to predict rotor mast loads due to flapping stop contact. Aeroelastic model tests will be conducted to obtain data on mast impact loads for subsequent program validation. Conduct a parametric study of UH-1H rotor and pylon stiffness parameters and apply toward development of mast design load criteria. Analyze, design and fabricate a nonlinear hub spring system for the UH-1H. Flight test both the baseline and modified (with hub spring) UH-1H in high flapping maneuvers to investigate hub spring characteristics.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0026, VALIDATION OF AEROELASTIC TAILORING BY STATIC AEROELASTIC AND FLUTTER TESTS

A.E. ALLIS, General Dynamics Corporation, *P.O. Box 748, Fort Worth, Texas* 76101 (DF138210; F33615-77-C-3105)

This work supports the functional area of aircraft aeroelastic design involving flight safety and improved aerodynamic performance. Aeroelastic tailoring of composites offers the potential of designing aircraft lifting surfaces to be free from aeroelastic instabilities, provide the required strength margins and improve certain aerodynamic qualities such as improved lift or reduced drag. The work unit will address the validation and quantification of the benefits obtainable through aeroelastic tailoring. The specific objective of this work is to experimentally verify that aeroelastic tailoring of filamentary composite structures for Air Force aircraft will enhance performance and provide a life-cycle cost savings. Preliminary analysis results indicate ten percent improvement in turn rate and range can be achieved for a lightweight fighter design and a 15 percent range improvement is possible for a bomber design when aeroelastic tailoring is incorporated. In order to be a usable design concept, an aeroelastically tailored design must also be compatible with cost-effective manufacturing concepts, retain the tailored stiffness and strength

throughout the service life of the aircraft, and demonstrate the performance gains.

To adequately demonstrate the capability to meet the above stated objectives, scaled models of a representative configuration will be tested to measure aerodynamic performance and deflections under actual airloads and to determine flutter characteristics in a wind tunnel. The tailored stiffness properties of the full-scale design will be scaled in the static aeroelastic model for transonic testing. Stiffness and mass will be scaled in the flutter model. The models will be fabricated in composite materials to duplicate the anisotropic properties. Prior to wind tunnel testing, static load deflection and proof tests will be conducted.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0027, FORWARD SWEPT WING ANALYSIS

S.K. HADLEY, General Dynamics Corporation, *P.O. Box 748, Fort Worth, Texas* 76101 (DF140910; F33615-77-C-3133)

There are several planned approaches to improved performance of high speed fighter aircraft in transonic maneuvering. Current deficiencies in this area indicate the need for major innovation to achieve large advantages in air combat maneuvering. One such innovation utilizes forward swept wings to overcome many present aerodynamic deficiencies. Until recently this concept suffered from loss of static stability due to wing tip deflection departure. The recent breakthroughs in aeroelastic tailoring at wing structure may lead to resolution of this tip departure problem and realization of substantial performance improvement. A detailed analysis is required to examine the full potential of forward swept wings for advanced fighter aircraft.

An investigation of the aerodynamic and aeroelastic implication of forward swept wings will be carried out using current analysis methods. studies will be cast in framework of planned mission requirements using advanced aft swept base lines.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

1.0028, HT PP 78-06 - ENGINE HEAT REJECTION ANALYSIS

P. CHESSER, U.S. Army, Applied Technology Laboratory, *Fort Eustis, Newport News, Virginia* 23604 (DA0E3809)

The objective of this planned in-house effort is to determine the effects on engine cooling requirements and performance which would result from reduction of heat rejection by various insulation techniques, compartmentalized cooling, and engine case design techniques.

The task will involve a review of (1) UTTAS and AAH compartment cooling data, (2) data relative to maximum and minimum allowable temperatures and (3) Air Force, Navy and commercial procedures for handling heat rejection as it relates to temperature critical controls and accessories.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0029, HT RM 78-18 - COMBAT MAINTENANCE CONCEPTS AND REPAIR TECHNIQUES (FLUID LINES)

UNKNOWN, U.S. Army, Applied Technology Laboratory, *Fort Eustis, Newport News, Virginia* 23604 (DA0E3827)

To design and fabricate interim- and quick-fix repair kits for leaking fuel/oil/hydraulic lines on the AH-1 helicopter.

An in-house effort will identify all fluid lines and fittings on the AH-1 and establish a fluid line size or sizes to be used to bypass any leaking fluid line. In addition, the identification of several quick-fix concepts to repair the damaged fluid line on aircraft will be accomplished. Contractual effort following will design and fabricate quick-fix kits identified by this laboratory and demonstrate the kit or kits fabricated on an operational AH-1.

SUPPORTED BY U.S. Dept. of Defense, Aviation Research & Development Command, Research & Technology Lab.

1.0030, ELECTROMAGNETIC COUPLING ANALYSIS OF LEARJET AIRCRAFT

J.W. SCHOMER, Boeing Company, *7555 E. Marginal Way South, Seattle, Washington* 98108 (DF141290; F33615-77-C-2058)

The work supports the overall mission of increased safety of flight of advanced technology aircraft in adverse electromagnetic (EM) and all-weather environments. Induced electrical transients due to direct and nearby lightning strikes can cause system upset and damage to flight and mission critical avionics systems. The purpose of the work effort is to develop and apply EM coupling models in the form of computer codes to predict and interpret the time and frequency response of induced voltage and current transients on selected cables and circuits within a NASA Learjet aircraft caused by lightning and EM field effects.

A NASA Learjet aircraft has been instrumented with electric and magnetic field sensors and current sensors to obtain in-flight data in thunderstorm environments at Kennedy Space Center during the months of Jul and Aug 77. Ground tests will also be run to obtain additional induced effects data. Test data will be compared with analytical predictions and results using developed computer codes. A final report will describe model development, computer codes, test and model verification results, data comparisons, and model modifications.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Flight Dynamics Lab.

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, EXPERIMENT FOR MATERIALS PROCESSING IN SPACE ENTITLED 'ULTRA PURE METALS PREPARATION IN SPACE'

R.F. BUNSHAH, Univ. of California, School of Engin. & Appl. Sci., Materials, *405 Hilgard Ave., Los Angeles, California* 90024 (NAS 8-33115)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0002, GROWTH OF LARGE SINGLE CRYSTALS OF GAN

W.A. TILLER, Stanford University, School of Engineering, Materials Science & Engin, *Palo Alto, California* 94305 (DN890057; N00019-78-C-0105)

The primary objective will be to study in depth the existing information concerning the preparation and properties of GaN single crystals and to study the applicability of several new techniques toward the growth of large crystals.

The GaN investigation will consist of 2 phases, namely (1) an analytical review and theoretical analysis of existing crystal growth procedures and of thermodynamic data relevant to possible new methods and (2) an experimental program. In phase 1 existing techniques for the preparation and growth of GaN will be evaluated for suitability to the growth of large crystals. Phase 2 will be a concurrent experimental program which at the outset will focus on two methods (1) solution growth (Ga solvent) in a temperature gradient and (2) growth from solutions with enhanced nitrogen solubility.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0003, NAVY ENVIRONMENT - CATALYTIC REMOVAL OF TOXIC GASES

D.A. VROOM, Intelcom Rad. Technology, *7650 Convoy Ct., San Diego, California* 92138 (DN223249; N00014-77-C-0255)

The Navy has a keen interest in devising new methods for producing nitrogen based explosives and rocket propellants. Investigating the chemisorption of nitrogen and the chemistry of reactive nitrogen atoms on catalytically active surfaces will provide information on novel methods for producing nitrogen compounds by catalytic means. Also, nitrogen surface interactions are

involved in such applications as rocket thrusters. A study of decomposition reactions of nitrogen compounds such as hydrazine will lead to improved methods of handling, storing and transporting nitrogen based propellants and explosives.

Low energy electron diffraction, auger electron spectroscopy, mass spectrometry and molecular beam techniques will be used to study surface chemical reactions of nitrogen and its compounds on single and polycrystalline surfaces of platinum, iron and other group VIII transition metals. The study will include an investigation of the decomposition of hydrazine and nitrous oxide on catalytically active surfaces.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0004, MEASUREMENT OF OPTICAL PROPERTIES FOR GREAT LAKES ORGANIC AND INORGANIC SPECIES
R.W. AUSTIN, Univ. of California, Graduate School, Oceanography, *P.O. Box 109, San Diego, California* 92037 (NAS 3-21386)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0005, MAGNETIC RESONANCE STUDIES OF THE MECHANISTIC ROLE OF METAL IONS IN CHEMICAL EVOLUTION
D.H. BUTTLAIRE, Calif. State Univ. & Colleges, School of Natural Sciences, Chemistry, *1600 Holloway Ave., San Francisco, California* 94132 (NCA 2-660804)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0006, METAL IONS AND THE EVOLUTION OF PHOTOSYNTHESIS
J.B. ORENBERG, Calif. State Univ. & Colleges, School of Natural Sciences, Chemistry, *1600 Holloway Ave., San Francisco, California* 94132 (NCA 2-660805)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0007, RADIATION CHEMISTRY STUDIES OF CARBON SUBOXIDE POLYMERS - AN INVESTIGATION OF A PROPOSED PRE-BIOTIC LINK TO THE ORIGINS OF LIFE
A.C. LING, Calif. State Univ. & Colleges, School of Science, Chemistry, *Washington Sq., San Jose, California* 95114 (NCA 2-675810)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0008, HEAT STORAGE IN ALLOY TRANSFORMATION
C.E. BIRCHENALL, Univ. of Delaware, School of Engineering, Chemical Engin, *Newark, Delaware* 19711 (NSG 3184)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0009, GRAPHITE FIBER RISK ASSESSMENT
D. GROSS, George Washington Univ., School of Engin. & Appl. Sci., Operations Research, *725 23rd St. N.W., Washington, District of Columbia* 20037 (NSG 1556)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0010, ACETYLACETONE, MMH REACTION BYPRODUCTS, AND PORTABLE SCRUBBING ASPIRATOR STUDY
J.J. THOMAS, Florida Inst. of Technology, School of Science & Engin., Chemistry, *Country Club Rd., Melbourne, Florida* 32901 (NAS10-9461)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0011, MULTIPLE FREQUENCY CARBON-13 SPIN RELAXATION AND ELUCIDATION OF COMPLEX MOLECULAR DYNAMICS
G.C. LEVY, State University of Fla. Sys., School of Arts & Sciences, Chemistry, *205 Wildwood Dr., Tallahassee, Florida* 32306 (CHE77-26473)

Dr. Levy plans to use carbon-13 spin relaxation data obtained at several widely separated frequencies (magnetic field strengths) to give unique information about dynamic processes in complex organic molecular systems. These experiments and derived theoretical treatments will probe the form of the autocorrelation function for individual carbon sites in synthetic polymers, strongly associated low molecular weight organic molecules, and in several biopolymer structures. Dr. Levy has recently shown that carbon-13 T1's in these systems do not necessarily follow current theoretical explanations. The variable frequency measurements probe correlated or cooperative internal motions in a structure. Specific applications deal with short and long methylene carbon chains having motional constraints at one or more sites. These studies will modify our conceptual framework to more completely understand the dynamic processes of chain motions in complex systems such as lipid bilayers and other organized structures. This research is a continuation of that currently supported by Foundation Grant, CHE-7681738.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

3.0012, NMR STUDY OF VISCOELASTIC FLUIDS AND ELASTOMERS UNDER EXTREME CONDITIONS OF TEMPERATURE AND PRESSURE
J. JONAS, Univ. of Illinois, School of Engineering, Chemistry & Chemical Engin, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (DF046940; AF-AFOSR-3185-77)

AF function - advanced aircraft systems employ viscoelastic fluids, elastomers and amorphous polymers as elastohydrodynamic lubricants, sealants, fuels and matrices which are subject to operation at high pressures and temperatures. Deficiency - the basic principles and parameters governing the behavior of viscoelasic fluids and materials, their dependence upon temperature and pressure and their correlations with molecular structure are not understood. Objective - using nuclear magnetic resonance relaxation techniques the dynamic structure of viscoelastic materials and fluids will be studied over wide ranges of temperature, pressure and viscosity. How work contributes - it is expected that this research will establish molecular structure-property relationships which can be utilized to predict and improve the life expectancy of viscoelastic fluids and materials for operational and future aircraft.

Systematic studies shall be conducted on (1) the dynamic structure of fluorosilicone elastomers for integral fuel tank sealants, (2) investigating model systems to elucidate the effects of molecular structure on the dynamic behavior, shear viscosity, and glass transition, to test current theoretical models for the glass transition, and elucidate problems related to glass transition in amorphous polymers of current Air Force importance, (3) NMR rotating coordinate frame characterization of very slow motional processes with measurement of self-diffusion and shear viscosities and the use of pressure to separate the effects of volume and temperature on molecular motions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0013, FRACTURE OF ADHESIVE JOINTS
S.S. WANG, Univ. of Illinois, School of Engineering, Theoretical & Applied Mech, *2527 Hydrosystems Lab., Urbana, Illinois* 61801

This study is concerned with the crack tip stress distributions and fracture phenomena associated with the thin polymer adhesive layers used to bond metal or composite adherends, such as those employed in advanced performance aircraft. Both theoretical and experimental approaches are being pursued; the purpose is to relate the fracture toughness of the polymer, as measured in the bulk material, to the strength of the adhesive joint.

SUPPORTED BY University of Illinois

3.0014, VIBRATIONAL ENERGY TRANSFER AND RELAXATION PATTERNS IN NONEQUILIBRIUM CHEMICAL SYSTEMS
A. BENSHAUL, Hebrew University of Jerusalem, *P.O. Box 499, Jerusalem, Israel* (DF289530; AF-AFOSR-3443-77)

AF function - research in molecular dynamics. Deficiency - Air Force capabilities in flight operations require continuing advances in technologies such as electromagnetic weaponry and plume technology. Research - the research is part of a program directed toward obtaining a better understanding of the energy transfer process between excited molecules. Among the specific questions to be studied are the relaxation pattern of a system of anharmonic diatomic molecules and the conditions of the existence of the anharmonic ladder climbing (Treanor) mechanism, as mean of further displacing the system from vibrational equilibrium. How research contributes - the development of a new technique for the theoretical prediction of vibrational relaxation patterns in nonequilibrium molecular systems greatly broadens the ability of researchers to investigate hitherto unexplored systems. The investigation of such systems could contribute significantly to the development of a chemically pumped laser device.

In this thermodynamic-like approach one generally solves only very few equations of motions governing the time evolution of the so-called 'informative macroscopic observables.' The molecular level populations at each instant are determined by maximizing an appropriate generalized entropy function subject to the corresponding values of the informative observables.

SUPPORTED BY U.S. Dept. of Defense, Air Force, European Office of Aerospace Research & Development

3.0015, INELASTIC AND REACTIVE COLLISIONS INVOLVING LiH MOLECULES - A COLLABORATIVE EXPERIMENTAL AND THEORETICAL STUDY
P.J. DAGDIGIAN, Johns Hopkins University, School of Arts & Sciences, Chemistry, *Charles & 34th Sts., Baltimore, Maryland* 21218 (CHE78-08729)

This research is in the area of quantum chemistry. It represents a collaborative study of the dynamics of rotational and vibrational energy transfer by investigators at the Department of Chemistry and at the Applied Physics Laboratory of Johns Hopkins University and at the University of Maryland. Research is planned in three major directions: 1) The laser-induced fluorescence study of rotationally inelastic collisions of state selected LiH molecules will be expanded to include various polar molecule targets, which will permit a direct investigation of R yields R energy transfer. The ab initio many-body perturbation-theory LiH-atom surfaces will be used to evaluate and calibrate various semi-empirical surfaces. Similar techniques will then be applied to the more complex LiH-molecule systems. 2) Vibrational energy transfer under single collision conditions will be investigated by using vibrationally excited target molecules, produced by infrared laser irradiation, to collisionally pump the LiH beam. 3) The on-going research effort will be extended to reactive collisions involving LiH, with particular emphasis on the isotopic exchange reaction 7LiH plus 6Li yields 6LiH plus 7Li. Ab initio calculations will be made to describe the necessary features of the adiabatic Li2H surface, which will then be used in studies of the reaction dynamics.

This research represents a continuation of that currently supported by Foundation grant CHE-7611359.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

3.0016, QUANTUM MECHANICAL STUDIES OF THE COUPLING BETWEEN ELECTRONIC AND VIBRATIONAL STATES
R.J. SILBEY, Mass. Inst. of Technology, School of Science, Chemistry, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (CHE78-07515)

Professor Silbey will conduct research aimed at increasing theoretical understanding of processes involving interactions of solids with energy or of solid surfaces with molecules.

Research in molecular energy transfer in solids will focus on development of the theory of energy transport, including coupling between vibrational modes, vibrational relaxation, and many trapping sites. Problems to be treated are (a) the derivation of macroscopic equation governing transport from microscopic models; (b) the inclusion of both acoustic and optical modes; (c) the possibility of 'hot' transport; (d) the description of experiments on energy transport in highly mixed crystals.

In research on interactions between high and low frequency modes, Professor Silbey will apply his theories on exciton-vibration and electron-vibration coupling to the study of excited state Jahn-Teller systems which are coupled to other electronic states.

Studies will be made of models of adsorption, particularly on the effects of a nearby metal surface on the interaction between atoms. The angular dependence of the potential between linear or planar molecules and metal surfaces will be examined theoretically. Self-consistent calculations will be made of work function and surface dipole barriers and the effects of steps and ledges on electronic densities near surfaces.

This grant renews support of a research program currently supported under NSF Grant CHE-7508184.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

3.0017, WAVE PROPAGATION IN FIBER COMPOSITES RELATING TO ACOUSTIC-ULTRASONIC NDE TECHNIQUES
J.H. WILLIAMS, Mass. Inst. of Technology, School of Engineering, Mech Engin, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 3210)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0018, DIFFUSION MODELING OF CYCLIC OXIDATION TRANSPORT PROCESSES IN BI-BASE ALLOYS
R.W. HECKEL, Michigan Technological Univ., School of Engineering, Metallurgical Engin, *Houghton, Michigan* 49931 (NSG 3215)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0019, POLYIMIDE MODEL COMPOUNDS
J.R. PRATT, Mississippi Univ. for Women, Graduate School, *Columbus, Mississippi* 39701 (NSG 1539)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

3.0020, MATERIALS SUPPORT TECHNOLOGY - MICROSTRUCTURAL ANALYSIS OF SURFACE LAYER AND ITS EFFECT ON CRACK PROPAGATION
S. WEISSMANN, Rutgers The State University, School of Engineering, Materials Engineering, *Old Queens Bldg., New Brunswick, New Jersey* 08903 (DN775284; N0014-77-C-0191)

Alloys used in naval systems often fail by a fatigue mode. The ability to predict when a part will fail by fatigue would be a great asset since replacement could then be effected prior to failure

during routine maintenance. This predictive capability does not presently exist. This research is an attempt to provide such a capability.

Microbeam x-ray and double beam x-ray diffraction techniques will be investigated to determine their feasibility as means to non-destructively assess the cumulative damage (dislocation density) in alloys subject to fatigue testing. It is proposed to test the theory (developed using destructive techniques) that fatigue cracking occurs when the surface stress due to excess dislocation density reaches a specific value dependent only on the alloy. The effect of environment on the damage process is of particular interest. Selected steels, aluminum, and titanium alloys are to be investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

3.0021, THEORETICAL CALCULATION OF POTENTIAL ENERGY FUNCTIONS FOR ELECTRONICALLY EXCITED STATES OF MOLECULES

W.L. LUKEN, Duke University, Graduate School, Chemistry, *Durham, North Carolina* 27706 (9767-G6)

This report will comprise a theoretical investigation of excited state potential energy functions for applications to molecular spectroscopy and photochemistry. In particular, efforts will be directed toward the development of systematic and practical methods for treating the near degeneracies and avoided crossings characteristic of excited electronic states, especially those associated with interactions between excited intravalency states and low Rydberg states.

This work will be based upon configuration interaction calculations. The Non-Closed Shell Many Electron Theory of Sinanoglu will be used to systematically select the configurations to be used in these calculations. In addition, a new type of molecular virtual orbital (based on a local energy analysis) will be used to reduce the computational effort required to obtain accurate results. Initial calculations will examine potential curves of diatomic molecules such as N2, O2, and CO. Later calculations are planned for poly-atomic molecules such as ethylene, butadiene, and benzene.

These calculations will be performed on an IBM 370/165 computer located at the Triangle Universities Computation Center.

SUPPORTED BY American Chemical Society

3.0022, WIRE ROPE INVESTIGATION

UNKNOWN, Battelle Memorial Institute, Columbus Laboratory, *505 King Ave., Columbus, Ohio* 43201 (DN890020; N00019-77-C-0552)

To develop a material suitable for carrier arrestment cable that is more reliable than that currently in use.

Wire will be produced from commercially available alloys. This wire will then be tested under conditions simulating in-service use.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

3.0023, DISSOCIATION AND ENERGY TRANSFER IN DIATOMIC MOLECULES

W.F. BAILEY, U.S. Air Force, Aeropropulsion Laboratory, *Wright Patt. A.F.B., Dayton, Ohio* 45433 (DF461610)

Investigate dissociation processes in non-equilibrium plasmas. develop time-dependent coupled electron and molecular kinetics computer codes. Parameterize dissociation processes.

Use semi-classical vibrational exchange probabilities including rotational channels to solve the time-dependent master equation. Examine electron impact and thermal dissociation processes.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aero Propulsion Lab.

3.0024, CHEMICAL AND PHYSICAL ASPECTS OF MESOPHASE FORMATION DURING CARBON-CARBON COMPOSITE PROCESSING

J.J. GEBHARDT, General Electric Company, *3198 Chestnut St., Philadelphia, Pennsylvania* 19101 (DF050380; F49620-78-C-0006)

AF function - advanced strategic missile systems will employ carbon-carbon structural composite materials for nozzles and nosetips. Deficiency - the relation of the important microstructural features which determine properties and performance of composites to the physiochemical processes taking place during pressure pyrolysis are unknown. Objective - the objective of this research is to develop a fundamental understanding of the chemistry of formation of the graphite matrix precursor (mesophase) during pressure pyrolysis under simulated fabrication conditions. How work contributes - this research will contribute to the systematic development of a process chemistry base which will permit tailoring of the carbon-carbon processing cycle to obtain desired microstructures for achieving improved thermochemical and thermostructural response.

(1) The determination of viscosity, density, compressibility and other fundamental properties of a model compound such as phenanthrene and a typical commercial pitch as a function of processing temperatures, times and pressures. (2) The determination of the influence of pressure on the formation and characteristics of mesophase derived from a model compound and a commercial pitch in various time-temperature regimes. (3) The determination of the influence of carbon fiber surfaces and structural chemistry on mesophase formation. (4) Characterization of the physical and chemical aspects of graphitization of the mesophase formed during the aforementioned studies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

3.0025, A LASER STUDY OF THE LIFETIMES AND PROPERTIES OF HIGHLY EXCITED STATES IN CONDENSED MEDIA

M.R. TOPP, Univ. of Pennsylvania, School of Arts & Sciences, Chemistry, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (CHE76-10336 A02)

Dr. Topp will study the lifetimes and properties of highly excited molecular states in condensed media. He will use pulsed lasers for consecutive biphotonic populations of highly excited states and to detect the latter by studying their low quantum-yield fluorescence spectra. A principal advantage of this approach is that one may control the excitation pathway by varying the timing and frequency of incident pulses. Also, observations are made in a noise-free region of the spectrum.

He will study simple aromatic molecules for ease of comparison with existing experimental and theoretical data, and in particular to study the influence of isotope effects, other molecular substitution and of pH and solvent-solute dipolar interactions on excited-state lifetimes and energy levels.

Dr. Topp has recently demonstrated that these experimental techniques are appropriate using model systems. His new tunable laser apparatus will allow biphotonic excitation of energy levels up to about 7eV, and with time resolution of about 10 to the minus 14th power sec.

SUPPORTED BY U.S. National Science Foundation, Div. of Chemistry

3.0026, NEUTRON SCATTERING STUDIES OF DISORDERED ALLOYS

W.C. KOEHLER, U.S. Dept. of Energy, Oak Ridge National Lab., *P.O. Box X, Oak Ridge, Tennessee* 37831 (INT76-05794)

Scientists from Oak Ridge National Laboratory led by W.C. Koehler are cooperating with scientists from Osaka University led by Nobuhiko Kunitomi in a study, using neutron scattering techniques, of the dynamical and magnetic properties of disordered alloys. Included in the study are (1) the lattice dynamics of the mass defect alloys Pt-Ni and Cu-Au, and (2) magnetic excitations in the Ni-Pt system.

SUPPORTED BY U.S. National Science Foundation, Div. of International Programs

3.0027, A PRECISION DILATOMETER STUDY OF QUENCHED METALS AND ALLOYS
P. WILKES, Univ. of Wisconsin, School of Engineering, Mineral & Metallurgical Engin, *Madison, Wisconsin* 53706 (DMR76-04730 A01)

This is a continuation of a basic study of select quenched metals and alloys, using an ultrahigh sensitivity capacitance micrometer, with demonstrated sensitivity of less than 1 A and a long term stability of less than 20 A. This technique is being used to determine the vacancy volume of nickel where the enthalpy (Ef) and vibrational entropy (Sf) for vacancy formation are known. It will also be used to determine Ef and Sf on quenched gold and dilute gold alloys. This is a renewal of NSF Grant DMR76-04730.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

3.0028, ENERGY ABSORPTION MECHANISMS DURING CRACK PROPAGATION IN METAL MATRIX COMPOSITES
D.F. ADAMS, Univ. of Wyoming, School of Engineering, Civil Engin, *P.O. Box 3435, University Station, Laramie, Wyoming* 82070 (NSG 3217)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, DEVELOPING AND CHARACTERIZING IMPROVED RADIATION HARD TECHNOLOGY FOR SPACE APPLICATIONS (CMOS)
D.V. KERNS, Auburn University, School of Engineering, Electrical Engin, *Auburn, Alabama* 36830 (NAS 8-33092)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0002, LOW-COST LAUNCHER TECHNOLOGY EVALUATION AND INTEGRATION
J. PRATER, U.S. Army, Ground Equip. & Materials Dir., *Redstone Arsenal, Huntsville, Alabama* 35809 (DA0G1013)

The objectives of this task are: a. Integration of low-cost launcher technology into the free flight rocket technology program. B. Determination of the effect low-cost launcher technology has on mal-launch. C. Investigation of methods for eliminating blow-by in tip-off type launchers. D. Determination of mal-launch induced by blow-by elimination mechanisms.

Launchers using low-cost technology will be designed and fabricated. Flight test will be performed using rocket motors developed under a low-cost motor technology program. Optical lever and telemetry data will be used to determine rocket motions during launch. These data will be compared to data from earlier task to determine effort on launch accuracy.

SUPPORTED BY U.S. Dept. of Defense, Missile Research & Development Command, Free Flight Rocket Technical Office

4.0003, PARACHUTE ENERGY-ABSORBING DEVICES
J.A. JENNINGS, U.S. Navy, Natl. Parachute Test Range, *El Centro, California* 92243 (DN937025)

To provide fleet emergency egress systems with energy-absorbing devices which will limit the deceleration applied by the parachute to aircrew man during deployment. Objective of this development will be to reduce peak decelerations from 40 g's to the 15-20 g range. Such load reductions on personnel and equipment will extend the useful range of the survival equipment while reducing injury potential to personnel.

Metal deformation devices, high elongation polymers, and tearing devices were constructed and tested. All of these systems resulted in technical difficulties and/or undesirable features. In order to retrofit existing parachute/ejection seats, low bulk/weight/cost and adequate force limitation are all prime requisites. Present effort is centered upon ply-tear webbing, metal or plastic extrusion, and rotary metal deformation as the most promising energy absorbing mechanisms. These types of devices are being designed, fabricated, and competively tested and evaluated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0004, TIES PROTOTYPE SYSTEM HARDWARE DEVELOPMENT
UNKNOWN, Ford Aerospace & Comm. Corp., *Palo Alto, California* 94303 (DN881018; N62269-76-C-0032)

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0005, OPTIMAL DATA COMPRESSION ALGORITHMS
M.E. HELLMAN, Stanford University, School of Engineering, Electrical Engin, *Palo Alto, California* 94305 (DF036900; F44620-73-C-0065)

Air Force function spacecraft, air- or space-borne sensors for reconnaissance and surveillance, and ground-based sensors for Nuclear Test Ban Treaty monitoring have the common characteristic of remote gathering and transmission of large amounts of data. Deficiency - the onboard buffers, encoders, transmitters and ancillary devices place an excessive weight, power, and cost burden on the aerospace system. Objective - the objective of this program is to reduce that burden through data compression techniques easily implemented with low-complexity hardware. How work contributes - success here could result in significant cost reduction for data transmission systems.

The theory of branching processes with random environments will be used to try to show the optimality of time-invariant convolutional codes, as has been done for time-varying convolutional codes for the symmetric binary source. On general trellis coding theory, the theory would be adapted to speech-type distortion measures and ergodic composite sources, since these sources appear to be good models for time-shared video data and speech. Analytic and numerical design techniques for sliding block and trellis codes will be sought. Speech compression, joint source-channel encoding, and multiuser channels will be other areas of investigation.

ADDENDA: Supporting agency address is: AF Office of Scientific Research NM, Bldg 410, Bolling AFB, DC 20332

SUPPORTED BY U.S. Dept. of Defense, Air Force

4.0006, ADAPTIVE COMPENSATION TECHNIQUES
D.L. FRIED, Optical Sciences Company, *Placentia, California* 92670 (DF741800; F30602-77-C-0099)

The objective of this effort is to devise techniques which promote closed-loop adaptive optical control which are independent of transit time delays. Air Force missions in space surveillance/defense ultra precision pointing, tracking, target positional determination, identification and discrimination exceed the current capabilities of ground-based sensors and passive space-based surveillance systems. active optical sensors provide a basis for addressing this function. Transit time delays experienced in space-based surveillance and weaponry related ranges limit the usefulness and the applicability of adaptive techniques for laser beam control and precision beam pointing. Closed loop adaptive servo control bandwidths limited by propagation transit times are not adequate to correct for space-based active optical platform related perturbations.

Estimation techniques will be applied to adaptive loop closure procedures to effectively remove dependence on transit time effects.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0007, HIGH VOLTAGE DC GENERATOR SYSTEM
F. ECHOLOS, Signal Companies Incorporated, Air Research Manfacturing Co, *2525 W. 190th St., Torrance, California* 90509 (DN781391; N62269-76-C-0223)

To develop a HVDC generator system incorporating design techniques for reduction of ripple voltage, transient surge voltage and rectifier commutation spikes. This contract supports work unit ZA601, Agency Accession No. DN681080.

To review exploratory development design techniques that have proven feasible and incorporate them in a total generator regulator system design.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0008, VISCOUS FLOW IN THE REGION OF A ROUNDED TRAILING EDGE
H. MCDONALD, Scientific Res. Assoc. Inc., *Glastonbury, Connecticut* 06033 (DN790084; N00019-77-C-0463)

Analytical investigation and computation of the viscous flow in the region of a rounded trailing edge of an airfoil including the interaction with the outer inviscid flow.

Theoretical study.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0009, SATELLITE DISINTEGRATION DYNAMICS
W.B. HEARD, U.S. Navy, Res. Laboratory, *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680433)

The purpose of this effort is to analyze foreign and domestic satellite explosions and their possible causes; to investigate satellite debris collision probabilities; the application of decoy strategies and counter-strategies and the stability analysis of satellite constellations, applications to satellite defense and A-SAT applications.

The particle ensemble will be modeled as a continuum of particles in phase space which animates from a point source with a distribution of momenta. This model will be used to study the evolution of the ensemble when the momentum distribution is known; to solve the inverse problem of deducting the initial momentum distribution from subsequent observation of the ensemble, to study the effects of a point source acting over a finite interval of time; and to determine the asymptotic distribution of the particles as the time since initial dispersion becomes very large.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

4.0010, APPLICATIONS OF ACOUSTICS IN THE MEASUREMENT OF COAL SLAB THICKNESSES
A.D. PIERCE, Georgia Inst. of Technology, School of Engineering, Mech Engin, *225 North Ave. N.W., Atlanta, Georgia* 30332 (NAS 8-33093)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0011, MEASUREMENT OF FILM THICKNESS IN FACE SEALS
R.A. BURTON, Northwestern University, Technological Institute, Mech Engin & Astronautical Sci, *633 Clark St., Evanston, Illinois* 60201 (NAS 3-21261)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0012, ANALYTICAL AND MODELING STUDIES OF PLUME INDUCED FLOW SEPARATION FROM AFTERBODIES
H.H. KORST, Univ. of Illinois, School of Engineering, Mech & Industrial Engin, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (DAAG 29-76-D-0100)

Plume induced slipstream separation from afterbodies, which can cause severe impairment of flight behavior of rockets and space vehicles, is analyzed by utilization of theoretical flow component models. While continuous refinement of computer based digital simulations of entire afterbody flow fields has led to a principal understanding of the complex interaction mechanisms, experimental studies are still required for generating reliable quantitative design data. Since economic considerations generally limit the scope of experimental (wind tunnel) programs, modeling is needed to identify relevant test parameters and, furthermore, to interpret test results for extended ranges of operating conditions. Of special interest is the use of techniques which are not based on conventional modeling laws but rather seek to produce interpretable results by correspondence of controllable effects. The simulation of plume induced separation by rigid disks or radial jets located in the body wake is analyzed, compared to wind tunnel data and interpreted for both planning of model experiments and corresponding prototype performance.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0013, MINIMUM-FUEL, THREE-IMPULSE ASCENT TRAJECTORIES
J.E. PRUSSING, Univ. of Illinois, School of Engineering, Aeronautical & Astronaut Engin, *2527 Hydrosystems Lab., Urbana, Illinois* 61801

General solutions for minimum-fuel, time-open, three-impulse ascent trajectories from a planet surface to an arbitrary circular orbit are not known. From existing two-impulse solutions it has been shown that the addition of a third impulse can result in a savings in fuel. A general solution for the three-impulse case is being investigated using primer vector theory.

SUPPORTED BY University of Illinois

4.0014, SURFACE STATE NOISE IN SI
C.T. SAH, Univ. of Illinois, School of Engineering, Electrical Engin, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (DF902990; F19628-77-C-0138)

AF function - signal processing and communication. Deficiency/opportunity - the presence of interface (surface) states which degrade the efficiency of the charge transfer process and increase the noise of CCD and related device structures basic to advanced signal processing circuitry. Objective - to minimize and control the effects of interface states on device operation through the development of circuit models for the noise generators in these devices. How research contributes - the analysis and measurement of noise spectral data will allow the construction of appropriate circuit models and increased understanding of the origin of the interface states will aid in minimizing and controlling device effects through processing modifications or design changes.

To take and analyze noise data in MOS transistor and CCD-like structures in order to understand the origin of the interface states and to develop detailed circuit models to describe the L/F noise generator in the equivalent circuit models of these devices. Noise measurements spectra as a function of bias conditions, frequency, temperature and interface surface state density will be taken and analyzed by high-speed automatic techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0015, ANTI-SUFFOCATION VALVE
R. CRAMER, Bendix Corporation, *Davenport, Iowa* (DN781214; N62269-76-R-0214)

To develop an anti-suffocation valve for use integrally with the A-13A oxygen mask, hose, and regulator. This valve will function only in egress situations and will be inoperative during normal in-flight conditions. It will protect the unconscious aircrew space member against suffocation in the event the emergency oxygen system becomes depleted. this contract supports work unit ZA601, Agency Accession No. DN681080.

Proposals have been solicited from industry to develop an anti-suffocation valve that will integrate with the A-13 mask, hose, and regulator.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0016, LASER MANIPULATION OF METALLIC VAPORS

UNKNOWN, Univ. of Iowa, Graduate School, *4 Jessup Hall, Iowa City, Iowa* 52240 (NSG 2327)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0017, RADAR DISCRIMINATION OF OIL SPILLS ON THE SEA

R.K. MOORE, Univ. of Kansas, School of Engineering, Electrical Engin, *Learned Hall, Lawrence, Kansas* 66044 (NSG 1554)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0018, DETERMINATION OF FREE FIELD EMP RESPONSE OF A SYSTEM FROM DIRECTLY COUPLED EXCITATION

L.W. PEARSON, Univ. of Kentucky, School of Engineering, Electrical Engin, *Limestone & Euclid, Lexington, Kentucky* 40506 (DN775384; N00014-77-C-0362)

The protection of Navy weapons systems such as ships and aircraft against the electromagnetic pulse (EMP) generated by nuclear detonation is a critical problem. Current EMP protective design is limited by the impracticality of free field experiments on such large systems and the viability at present to model large complex structures. The objective of this program is to develop a theoretical technique based on the singularity expansion method of determining the free field EMP response from direct coupled current excitation measurements.

In the directly coupled excitation method, a pulse transient current is capacitively coupled to the test object through a decal-mounted probe, and the induced surface currents are measured at a number of points on the object. There is no means at present to relate these measurements to the actual case of far-field excitation by an EMP. This research will develop a theoretical analytical method to determine the free space response from directly coupled current measurements based on the singularity expansion method, which represents current response in terms of poles in the complex frequency plane (i.e., natural resonances). The essential theoretical problem is to develop a method of determining the poles and coupling coefficient from directly coupled current measurements. The essential practical problems are to develop an efficient mathematical technique to accomplish this, and to minimize the effects of noise.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0019, PERFORM ECONOMIC ANALYSIS/LIFE-CYCLE COST STUDY OF MNOS MEMORY

J. BREWER, Westinghouse Electric Corp., *P.O. Box 746, Baltimore, Maryland* 21203 (DN781281; N62269-76-M-8549)

Technical objective - future and current Navy platform requirements indicate improvement is desired in the area of weight, reliability, maintainability, power, and access/cycletime. Currently, various memory technologies are being developed to replace discs and drums with emphasis on improvement in those areas. The memory technology being considered in this task is the MNOS (metal nitride oxide semiconductor). The objective of this program is to perform economic analysis/life-cycle cost study of mnos technology to predict the cost of ownership. (This includes R & D, acquisition and operational support.) This contract will support work unit ZC902, Agency Accession No. DN 681082.

Approach - contract MNOS producer and user to perform this study.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0020, NAVY VEHICLE DESIGN AND CONSTRUCTION - BOUNDARY VALUE AND NATURAL FREQUENCY ANALYSIS OF THIN SHELL STRUCTURES

B.K. DONALDSON, Univ. of Maryland, School of Engineering, Aerospace Engineering, *College Park, Maryland* 20740 (DN675635; N00014-76-C-0872)

Novel analytical techniques will be explored under this effort for the purpose of more effectively and efficiently determining the structural response of pertinent portions of naval vehicle systems.

Finite-difference energy techniques with arbitrary meshes will be extended to apply to (a) concentrated or rapid load gradient problems, (b) elastoplastic analyses and (c) combined finite-element/finite-difference schemes. For arbitrary meshes a generalized approach which avoids inaccuracies due to concentrated or sharply varying loads as well as plastic material behavior will be employed. Finite element techniques are generally more efficient in the vicinity of complex boundaries and finite difference methods more cost-effective in regular domains. The two techniques will be employed via an energy method and connected at their interface by common nodes.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0021, INVESTIGATIONS OF DIAGNOSTIC TECHNIQUES APPLICABLE TO PULSED VISIBLE DYE LASERS

T.J. MCILRATH, Univ. of Maryland, Inst. for Physical Sci. & Tech, *College Park, Maryland* 20742 (NAS 5-25132)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0022, BOUNDARY LAYER RESEARCH

R.E. LEE, U.S. Navy, Weapon Dynamics Division, *Silver Spring, Maryland* 20910 (DN785078)

Develop the aerodynamic technology required to improve the kill probability of the present air-launched weapons as well as identify and produce such technology in order to meet the needs of the advanced air-launched missile systems of the future. Influence of wall temperature of sharp-tipped cones on boundary layer transition in supersonic free flight and (c) to continue the analysis of turbulent boundary layer data from previous test programs.

By means of analytical methods and experimental procedures in ground test facilities produce aerodynamic knowledge to fulfill the above objective. Specifically, develop methods of predicting transition and augmentated heating due to roughness on missile seeker domes. Also, determine the tracking error resulting from bending of lightlrays that traverse the bow shock and the shock layer in front of the seeker dome at high supersonic Mach numbers. Advanced diagnostic techniques will be used in wind-tunnel tests to produce a data base from which empirical methods will be developed for predicting flow about missile bodies at high angle of attack, including induced side forces. Results from analytic computations, wind-tunnel and free-flight tests will be used to demonstrate the feasibility of electrostatic sensors as means of measuring the attitude of a missile in flight.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0023, LASER DOPPLER AIRSPEED AND ALTITUDE SENSOR

M. RUDD, Bolt Beranek & Newman Inc., *50 Moulton St., Cambridge, Massachusetts* 02138 (DF051140; F49620-78-C-0023)

AF function - control of aircraft requires accurate sensing of speed and altitude over wide range of flight regimes. Opportunity -lasers allow optical sensing of air data where present mechanical means may fail or lose accuracy. This sensing occurs without flow field distortion, and renders inherently more accurate informa-

tion. Objective - provide full-range velocity measurement capability (0 to Mach 10) in addition to angle of attack and sideslip, pressure altitude and flight path acceleration data. How work contributes - extends present flight data capability at high altitude, hypersonic speed and in maneuvers. Complements present instrumentation, aids flight safety.

Laser light is focused in front of the vehicle in the undistorted flow region. Backscattered radiation from CO2 molecules at 4.3 micron resonance is collected. Laser tuning establishes spectroscopically scattered light frequency shift and linewidth, from which flight velocity and altitude are derived.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

4.0024, RELATIONSHIPS BETWEEN QUADRATIC WEIGHTS AND LINEAR QUADRATIC REGULATOR PROPERTIES

G. STEIN, Mass. Inst. of Technology, Graduate School, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 1553)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0025, DESIGN AND DEVELOPMENT OF LINEAR ACCELERATOR

D.J. ANDERSON, Univ. of Michigan, School of Medicine, Otorhinolaryngology, *1335 E. Catherine St., Ann Arbor, Michigan* 48104 (NAS 9-15683)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0026, ELECTRONIC SYSTEM PARTS FOR GALILEO PROBE NEUTRAL MASS SPECTROMETER

G.R. CARIGNAN, Univ. of Michigan, School of Engineering, Electrical & Computer Engin, *Ann Arbor, Michigan* 48106 (NAS 5-25145)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0027, FABRICATION OF ELECTRONIC SYSTEM FOR THE GALILEO PROBE NEUTRAL MASS SPECTROMETER

G.R. CARIGNAN, Univ. of Michigan, School of Engineering, Electrical & Computer Engin, *Ann Arbor, Michigan* 48106 (NAS 5-25153)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0028, VIRTUAL IMAGE DISPLAY SYSTEM

K.F. OCONNOR, Advanced Technology Systems, *450 W. 1ST Ave., Elizabeth, New Jersey* 07203 (DN794045; N61339-77-C-0113)

This virtual image display system will be an efficient, lightweight, compact, low-cost virtual image device which is needed for synthetic flight trainers and tank driven simulators.

The virtual image display system will contain a combination of optical elements that convert a real image, such as a television tube, into a virtual image such that the scenery appears to be at the real world distances.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Training Equipment Center

4.0029, DEVELOPMENT OF AIR DYNAMOMETER DESIGN DATA

W.P. SULE, U.S. Navy, Air Engineering Center, *Lakehurst Naval Air Station, Lakehurst, New Jersey* 08733 (DN696015; N68335-75-C-2098)

To develop air dynamometers for use as load-absorbing devices for the ground-testing of turboshaft engines.

Analytical and model testing will be used to advance the state-of-the-art in air dyno technology to produce the design data needed to develop future test system as new engines become operational.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0030, MOBILE ELECTRIC POWER PLANT DRIVE SYSTEM

W. UELINER, U.S. Navy, Air Engineering Center, *Lakehurst Naval Air Station, Lakehurst, New Jersey* 08733 (DN896007)

To design and test a drive system to be installed on a mobile electric power plant. Once designed and tested, the new system will replace existing drive systems on all new Navy purchases.

(a) Perform a study to determine the various methods of ground propulsion, (b) From study, determine cost and configuration of drive systems to be used on mobile electric power plant, (c) design and build drive system, (d) install and evaluate breadboard and (e) report on conclusions and make recommendations.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

4.0031, COMMUNICATIONS - ATOMSPHERIC UV SCATTERING

M.E. NEER, Aeronautical Res. Associates, *50 Washington Rd., Princeton, New Jersey* 08540 (DN775001; N00014-76-C-1094)

The Marine Corps has a need for a short-range communications system. The data obtained from this contract on UV scattering will be used to design a UV communications system for the Marine Corps. A second use for this basic data will be as backup for the Navy's solar blind missile detector.

The principal investigator will study solar-blind-region, UV scattering by aerosols in the atmosphere as a function of particulate size, etc.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0032, HANE PHENOMENOLOGY

J. JANNI, U.S. Air Force, Weapons Laboratory, *Kirtland A.F.B., Albuquerque, New Mexico* 87117 (DF193230)

The primary objectives for work under this task are to maintain and improve a unique in-house capability to compute nuclear radiation environments created by one or more high-altitude detonations. This technology development includes work which will allow environmental affects on satellites to be determined by improving satellite shielding techniques and radiation transport in complex geometries.

This will be a theoretical effort based on current physics and existing data. Early time nuclear debris expansion will be considered using quasi-linear plasma theory. Computer codes for modelling satellite geometry and performing radiation transport will be updated to include a variety of radiation environments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Weapons Lab.

4.0033, SURVEILLANCE - OPTICAL COMMUNICATION AND METAL SCREENING

L. FELSEN, Polytechnic Inst. of New York, Graduate School, Aerospace Engin & Applied Mech, *333 Jay St., Brooklyn, New York* 11201 (DN475357; N00014-76-C-0144)

The loss of information from optical sources at high altitudes as a result of propagation through a turbulent atmosphere as well as means for compensating or correcting for the image distortion of an object is of considerable importance to the Navy and DARPA for development of advanced surveillance equipment.

Various methods will be investigated for correcting image degradation due to atmospheric turbulence, diffraction, and photon noise with emphasis on dynamic compensation techniques and short exposure reception. The investigation will include: design of an adaptive compensator, determination of relevant turbulence statistics during reception, optimum methods for approximate phase compensation, statistical properties of speckle and

deconvolution in the presence of noise. In addition the loss of information from an optical source at high altitudes as a result of propagation through a turbulent atmosphere which is described by a non-Karman modified Kolmogorov correlation spectrum will be studied.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0034, BROODBOND ROTOR NOISE
A.R. GEORGE, Cornell University, School of Engineering, Aerospace Engineering, *242 Carpenter Hall, Ithaca, New York* 14850 (NSG 2331)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0035, TACTICAL TARGET INTERACTIVE RECOGNITION TECHNIQUES
UNKNOWN, Pattern Analysis Recog. Corp., *310 E. Chestnut St., Rome, New York* 13440 (DF911350; F30602-78-C-0095)

This effort will address the alternatives which appear to be most efficient and cost-effective to accomplish the goal of identifying tactical targets. Emphasis will be placed upon the key aids to decision making. Rapid interactive comparison of unknown target images and the library of previously cataloged targets will be stressed. The end product will emphasize the optimum real-time techniques/methods for the above cataloging and also must be acceptable to the eventual user, TAC. The USAF C3 capability is deficient in the ground systems inability to positively identify all tactical aircraft in the vicinity of the FEBA. Non-cooperative techniques to accomplish the tactical target identification (TTI) function are needed by the Tactical Air Command. This deficiency is elaborated in TN-ESD-AFCRL-RADC-1709-69-07 and TAC initiative 5-76. This effort is the second phase to continue to address the role of interactive processing of target data for identification purposes.

This effort stresses the identification process of the overall TTI program. This effort will emphasize the validation of previously developed (concepts of coherent wide band data) classification methodologies with real-world data. The determination of these techniques relative efficiency, timeliness, accuracy, human acceptability, and compatibility with the TTI function within the Tactical Air Control System shall be determined. The realm of the decision maker (AFFOR commander) will be explored to insure that the techniques/methods selected are reasonable and will satisfy the operational need. In addition to deciding how the data library will be designed and implemented, heavy emphasis will be placed upon the annunciation, such that the man/machine interface is optimized to improve the friendly force resource allocation. Enemy, unknown, and friendly aircraft will be tagged in the digital data base. Priority will be placed upon non-cooperative techniques to optimize the survivability of the friendlies.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0036, C-LAYER PROPAGATION FOR LONG-WAVE COMMUNICATIONS/NAVIGATION
J.E. RASMUSSEN, U.S. Air Force, Rome Air Development Ctr., *Griffiss Air Force Base, Rome, New York* 13440 (DF904010)

Objective: the propagation of VLF and LF radio waves is primarily a function of the reflectivity of the lower ionosphere. The existence and influence of the c-layer in VLF/LF propagation is an extremely controversial subject with the only direct observations being a very limited sample obtained by RADC/EEP at mid-latitude. Under this LDF work unit, c-layer measurements will be conducted at both mid- and polar latitudes utilizing high resolution ionosounding techniques developed at RADC/EEP. The mid-latitude measurements will be primarily aimed at determining optimum viewing angle, optimum ionosounding frequency, and c-layer diurnal stability. The polar experiments will investigate the existence of a discrete c-layer at high latitude.

C-layer measurements will be made at mid-latitude over a one year period to measure reflectivity as a function of viewing angle and ionosounding frequency along with diurnal and seasonal stability. Preliminary measurments will be conducted to determine the optimum experimental range. If time and resources permit, the study will proceed to verify the existence of a discrete c-layer in polar regions, measure the geomagnetic latitude cut-off, and determine magnetic azimuth effects. The data will be interpreted through full-wave pulse reflection computer programs to provide the ionospheric electron density profiles required to reliably calculate long path VLF and LF propagation for AF communications (MEECN) and navigation (OMEGA) systems.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Rome Air Development Center

4.0037, ELECTROMAGNETICS RESEARCH
C.H. WALTER, Ohio State University, School of Engineering, Electrical Engin, *190 N. Oval Dr., 102 Administration Bldg., Columbus, Ohio* 43212 (DN875143; N00014-78-C-0049)

The objectives of this program are to develop analytical techniques to treat radiation, scatter, and coupling from bodies of complex shape such as naval ships, aircraft, and missiles; to develop methods of optimizing the efficiency and radiation pattern of small antennas on such bodies; and to investigate optimization of waveform tagging and time constant control for adaptive arrays.

The geometric theory of diffraction is extended to treat a larger number of practical problems by developing means to properly treat diffraction from curved wedges, vertices, and radial electromagnetic fields. The extension of the geometric theory of diffraction by method of momegts is being investigated. The surface cell model is being improved by finding optimum expansion functions and faster methods for calculating electromagnetic coupling, by developing curved and triangular surface cells, and by developing special modes to satisfy edge conditions. The method of characteristic modes is being used to investigate optimization of radiation from small antennas by exciting the platform on which the antenna is mounted. Transient electromagnetic phenomena including design of efficient transient pulse antennas, and the relations between natural resonance poles and target shape are investigated.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0038, COMPUTER INTERACTIONS FOR DYNAMIC AEROSPACE PSYCHOPHYSIOLOGICAL STRESS STUDIES
B.D. FRITCHMAN, Lehigh University, School of Engin. & Phys. Sci., Electrical Engin, *Alumni Memorial Bldg., Bethlehem, Pennsylvania* 18015 (DN881343; N62269-77-)

To investigate the relevance of recent technical and conceptual developments in wide band communications and distributed digital processing to the structuring of data systems suitable for use in the conduct of complicated psychophysiological stress studies conducted in a dynamic, multi stress environment. Such systems would provide a flexible capability for the control of experiments in which the NavAirDevCen dynamic flight simulator DFS (human centrifuge) is used with advanced aircraft flight displays and for the collection and computer analysis of physiological, performance, and environmental data.

A thorough review shall be made of the information characteristics of advanced flight display and control systems to be used in the DFS, and of the kinds and amounts of data to be collected and analyzed. An assessment shall be made of the nature and availability of pertinent flight display generating systems and automatic data handling equipment currently located at the NavAirDevCen. Based upon the information so obtained, one or more systems shall be devised and described, together with pertinent components and interconnections, to achieve the technical objective, as described above, in the most cost-effective manner. proposals for phased implementation of the systems described shall also be included.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Development Center

4.0039, END WALL FLOWS IN ROTORS AND STATORS OF A SINGLE STAGE COMPRESSOR
B. LAKSHMINARAYANA, Penn. State University, School of Engineering, Aerospace Engineering, *101 Hammond Bldg., University Park, Pennsylvania* 16802 (NSG 3212)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

4.0040, ASW POD FOR CV TACTICAL AIRCRAFT
C. PHILLIPS, U.S. Navy, Air Development Center, *Warminster, Pennsylvania* 18974 (DN581412)

Minimize problems in fleet antisubmarine warfare relay systems by supporting NavAir, NAFI, and contractors with facilities and technical staff essential for evaluation of total system and/or components for development through production and use.

Operational requirement (OR-WAS-30) established the parameters and guidelines for the development of an ASW pod which will provide tactical aircraft with a sonobuoy disperse and signal relay capability. Work also being performed on contracts as reported in work units SX301 B1 to B3.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Avionics Facility

4.0041, COMMUNICATIONS - MULTIPLE AND/OR INHOMOGENEOUS LAYERS FOR INTEGRATED OPTICAL COUPLING AND MODULATION
A.B. BUCKMAN, Univ. of Texas, School of Engineering, Electrical Engin, *200 W. 21st, Austin, Texas* 78712 (DN575155; N00014-75-C-0753)

Research is conducted on multiple and inhomogeneous layer optical waveguide which may lead to improved optical devices such as more efficient modulators and second harmonic generation devices, or to new devices such as voltage controlled deflectors or Bragg filters for use in naval integrated optics, communications and data link systems.

Multilayer waveguides offer a potential two order of magnitude modulation enhancement over bulk electrooptic material. Practical limits on modulation enhancement caused by thickness errors, various fine-tuning methods to minimize mismatch, methods of eliminating multimode, and applications such as second harmonic generation will be investigated analytically and experimentally.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

4.0042, DYNAMIC SIMULATION OF COMPLEX STRUCTURES 15243-E
L. MEIROVITCH, Virginia Poly. Inst. & St. U., School of Engineering, Engineering Sc & Mech, *Burruss Hall, Blacksburg, Virginia* 24061 (DA0F9146; DAAG29-78-G-0038)

To carry out the dynamic simulation of complex structures and produce a mathematical formulation for the study of their vibrational characteristics. Relevance - AMRADCOM conducts research in vibration and dynamic loads for helicopters in both hover and forward flight. This work is vital in the analysis of the structural dynamics which is involved. This is particularly true when gyroscopic effects of the engine, main rotor and tail rotor loads and their interactions are to be considered.

The complex structure will be decomposed into a number of substructures, both gyroscopic and non-gyroscopic, after which the method of component mode synthesis will be applied.

SUPPORTED BY U.S. Dept. of Defense, Army Materiel Development & Readiness Command, Army Research Office

4.0043, INVESTIGATION OF MICROPROCESSORS FOR USE AS CONTROLLERS FOR TUNABLE DIODE LASERS
A.K. TREHAN, Hampton Institute, Graduate School, Electrical Engin & Computer Sc, *Hampton, Virginia* 23368 (NSG 1552)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production and Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, VIKING SITE CERTIFICATION
H. MASURSKY, U.S. Dept. of The Interior, Geological Survey, Geologic Division, *601 E. Cedar Ave., Flagstaff, Arizona* 86001 (8-9580-00988)

The landing site selection and certification effort for NASA's successful Viking mission to Mars is reviewed from the pre-mission phase through the acquisition of data and decisions during mission operations and the immediate post-landing evaluations. The utility and limitations of the orbital television and infrared data and ground-based radar observations of candidate and actual landing sites are evaluated. These observations could statistically minimize the hazards but could not define hazards and potential scientific return at the scale of the spacecraft. Additional instruments and types of observations that would have been useful and will be necessary to support future lander missions to Mars such as higher-resolution cameras, radar altimeters and hazard avoidance capability in the landing system are delineated. The principal hazard is the presence of blocks that might damage the lander; only very high resolution images will adequately record their presence.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0002, APPLICATION OF REMOTE SENSING FOR NATURAL RESOURCE ANALYSIS
E.L. SMITH, Univ. of Arizona, School of Agriculture, *Tucson, Arizona* 85721 (0058972; ARZT-2014-4168-026)

OBJECTIVE: Characterize basic land units in southeastern Arizona. Develop criteria for measuring productive potential, condition and trend on these units. Develop criteria for mapping associations of basic units. Gather information on properties and management of units.

APPROACH: Basic lands units will be identified on aerial photos and characterized by images pattern and field data. Once defined the units will be studied under different management histories to evaluate condition and trend criteria. Criteria for mapping associations of land units will be developed using other existing resource maps and imagery. The study will be concentrated in Santa Cruz County.

PROGRESS: A study was done to determine if changes in mesquite cover and/or density could be detected using stereoscopic interpretation of black and white aerial photos taken in 1936 and 1970. Both sets of photos were about the same scale and taken in winter. Plots of about 1/2 acre were delineated on photos and in field. Trees of less than 3 ft. crown diameter could not be detected with either high (4 1/2 x) or low (1 1/2 x) power. Trees of larger size could be accurately counted up to about 15% cover. No correlation was found between numbers of large and small trees. Cover was usually underestimated on sparse stands due to non-detection of small trees; cover estimates on denser stands compared well with field measurements. Utility of this technique to detect mesquite invasion was limited by inability to detect smaller trees. This problem might be reduced by using photos taken in late spring and/or color photos, but these are not available for a long span of years.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Arizona

5.0003, A PROPOSAL TO USE TIROS-N AVHRR DATA FOR MEASUREMENTS OF ATMOSPHERIC AEROSOLS
M. GRIGGS, Science Applications Inc., Remote Sensing Division, *1200 Prospect St., La Jolla, California* 92037 (8-683; M0-A01-78-00-4092)

OBJECTIVE: Develop a technique to infer atmospheric aerosol particle concentration over the earth's oceans using measurements of reflected solar radiation from the Advanced Very High Resolution Scanning Radiometer (AVHRR) on the TIROS-N series of satellites. Use this technique to produce maps of aerosol particle concentration.

APPROACH: During the first year, methods to simplify the mathematical representation of the relationship between reflected radiance and aerosol concentration for different viewing and solar zenith angles will be studied. Theoretical computations of the radiance of radiation reflected from the ocean and atmosphere at a particular wavelength, for solar zenith and satellite viewing angles expected for TIROS-N, and for aerosol particle concentrations varying from none to ten times normal, will be performed and analyzed. Simpler methods will be developed from this analysis.

Subsequent studies using coincident measurements of reflected radiance and aerosol concentration at several locations on the earth will test the validity of the mathematical representation and provide an empirical means of adjusting the expressions for better accuracy.

If these study results are positive, the technique will be developed into an operational product.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., National Environmental Satellite Service

5.0004, TECTONICS OF THE WESTERN MOJAVE DESERT

D.B. BURKE, U.S. Dept. of The Interior, Geological Survey, Geologic Division, *345 Middlefield Rd., Menlo Park, California* 94025 (9940-02090)

STATE TO WHICH PROJECT PERTAINS: California.

Actively deforming structures of potential earthquake hazard in the western Mojave Desert in southern California are being investigated by aerial photograph, field, and trench studies in order to determine the style and tempo of Holocene crustal deformation in the region. Detailed investigations of movement history center on portions of the Garlock, San Andreas, Willow Springs, Mirage Lake, Tylerhorse, and Oak Creek Canyon Faults, the northern foothill fault belt of the San Gabriel Mountains, and the San Hills Anticline. Kinematics of the region as a whole are being studied by mapping and paleomagnetic analysis of Cenozoic volcanic rocks in the larger structural blocks.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0005, NAVY ENVIRONMENT - REMOTE SYNOPTIC MEASUREMENT OF SURFACE CIRCULATION

J.D. ISAACS, Univ. of California, Inst. of Marine Resources, *P.O. Box 109, San Diego, California* 92038 (DN775038; N00014-76-C-1103)

The objective of this research is to develop a method for the remote synoptic measurement of ocean surface circulation. The remote, near-real time measurement of surface currents would be a highly valuable contribution in the planning and execution of Navy/Marine Corps operations in coastal waters.

This method relies on wavelength measurements of two distinct trains of gravity waves as they propagate through regions where surface circulation is to be determined. The method proposed here is basically simple, as it utilizes only wavelength measurements of two wave trains. The wavelength data will be determined from vertical aerial photographs. The photographs will be analyzed by optical data processing techniques to obtain the wavelength information from the two separate wave-trains propagating simultaneously. The waves will be generated by two wave generators of controlled frequency. The experimental work will include model simulation in a small basin located outdoors to simulate real illumination conditions for photography, and surface circulation measurement in a lagoon of a known and simple circulation. The results of these experiments will be evaluated for their application to surface circulation detection and measurement in harbors and larger bodies of water, both those accessible to ground measurements and otherwise; and the utility of local wind or ships' waves for such analysis.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

5.0006, THERMAL HISTORY OF ENSTATITE CHONDRITE METEORITES

UNKNOWN, Univ. of California, Graduate School, *P.O. Box 109, San Diego, California* 92037 (NSG 7474)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0007, DATA MANAGEMENT

C.B. EMMANUEL, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (8G172252)

PROJECT OBJECTIVE: Develop computer operating systems for processing and validating environmental research data gathered primarily from the Research Facilities (RFC) aircraft.

CURRENT YEAR PLAN: Continue with development of software for the aircraft data acquisition systems (meteorological and radar). The development of programs to produce RFC quality controlled standard data tapes from the aircraft data collection system continues.

PROGRESS REPORT: The first phase of the software development (graphic) has been accomplished. The ground based data management system is nearly complete.

SUPPORTED BY U.S. Dept. of Commerce, National Oceanic & Atmospheric Admin., Environmental Research Labs.

5.0008, RADAR OPTICAL COMPARISON

J.L. GREEN, U.S. Dept. of Commerce, Environmental Research Labs., *Boulder, Colorado* 80302 (RDJ40454)

OBJECTIVE: Obtain simultaneous measurements of height profiles of the wind velocity, the atmospheric turbulence structure constant Cn2, and other atmospheric parameters.

The Sunset Radar facility will make the necessary measurements required in the objectives and will correlate them with rawinsonde balloon data, thermosonde balloon data and data from special aircraft flights.

SUPPORTED BY University of Arizona

5.0009, MINERAL AND ROCK SPECTROSCOPY

G.R. HUNT, U.S. Dept. of The Interior, Geological Survey, Geologic Division, *Box 25046, Denver Federal Center, Denver, Colorado* 80225 (9790-01864)

The project objectives for 1978 are: a) record and interpret the visible and near infrared spectra of a variety of mineral, naturally occurring altered and unaltered rock, soil, and vegetation samples to determine and explain their spectral characteristics and diagnostic features and determine how they are modified by environmental parameters. These data will be used to determine design parameters for remote sensing equipment and to assist in the interpretation of data acquired from airborne and satellite multispectral scanner data; b) extend these studies to emission investigations in the thermal (mid-infrared) region; c) complete construction, test, and record in situ rock spectra with a prototype field portable grating spectrometer; d) modify the USGS aircraft-borne multispectral scanner to record data simultaneously through more than one near infrared bandpass.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0010, PHOTODETACHMENT CROSS SECTIONS AND SOLAR DETACHMENT RATES OF NO3-, NO2 AND CO4

S. WOO, Univ. of Delaware, School of Arts & Sciences, Physics, *Newark, Delaware* 19711 (ATM77-18324)

This grant funds an investigation to establish the threshold energies, the solar detachment rates and the absolute photodetachment cross sections of ground state NO3-, NO2-, and CO4- in the 1.7 to 4.5 eV photon energy range.

A mass-identified drift tube, operating in about 2 torr of pressure, will be used to cool the molecular negative ions to ground electronic and vibrational state. It then provides mobility selected and mass identified ions for photodetachment. A pulsed, tunable

dye laser, covering a wavelength range of 270 to 720 n.m. and having a resolution of three wave numbers per cm, will be used as the light source.

Photodetachment data from ground state molecular negative ions is required for the purpose of meaningful application to the analysis of transmission of electromagnetic waves through the stellar and earth atmosphere, and the purpose of manageable theoretical analysis. The ability to measure photodetachment cross section over a wide photon energy range allows more thorough examination of molecular structures besides providing absolute solar detachment rates. The three ions are of considerable interest to the study of D-region ion chemistry or the development of CO2 gas discharge lasers.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0011, STUDIES OF RADIATIVE TRANSFER IN THE EARTH'S ATMOSPHERE WITH EMPHASIS ON THE INFERENCE OF THE RADIATION BUDGET
H. LIEBOWITZ, George Washington Univ., School of Engin. & Appl. Sci., Civil Mechanical & Env Engin, *725 23rd St. N.W., Washington, District of Columbia* 20037 (NSG 1555)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0012, TEST FOR DIURNAL RAINFALL VARIATION USING NIMBUS 5 DATA
T.L. GILL, Howard University, Graduate School, *2400 6TH St. N.W., Washington, District of Columbia* 20001 (NSG 5295)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0013, DYNAMIC IONOSPHERIC MODELING (LAMINAR)
D.F. STROBEL, U.S. Navy, Res. Laboratory, *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN880024)

To develop multi-dimensional dynamic models of the thermosphere that describe the global structure of the neutral atmosphere and laminar ionosphere and its interaction and response to solar radiation and geomagnetic disturbances. The relevant codes will accept data from SOLRAD and other sensors and provide the capability to theoretically predict radio wave propagation paths in the ionosphere from DOD systems.

Multi-dimensional, reactive flow, electrostatic fluid codes that solve the equations of motion, continuity, and heat of a chemically reactive compressible fluid in a magnetic field will be used to study the response of the ionosphere to the deposition of solar radiation and geomagnetic disturbances.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

5.0014, EXPERIMENTAL SATELLITE COMMUNICATIONS PROGRAM FOR OCEANOGRAPHIC PURPOSES
O.B. BROWN, Univ. of Miami, School of Marine & Atm. Sci., *4600 Rickenbacker Causeway, Miami, Florida* 33149 (OCE78-07802)

This grant will provide support to implement, on an experimental basis, a ship-to-shore message and data handling communications system. The program will test the feasibility and utility of real time data and voice communication in the conduct of oceanographic field communication. A principal function of the grant will be to provide support for the University of Miami to act as liaison between NASA and the academic fleet to facilitate and coordinate use of the ATS system.

SUPPORTED BY U.S. National Science Foundation, Div. of Ocean Sciences

5.0015, GOECHEMISTRY OF LUNAR AND PLANETARY PROCESSES
J.A. PHILPOTTS, Univ. of Hawaii, Graduate School, *Spalding Hall, Room 359, Honolulu, Hawaii* 96822 (NSG 9071)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0016, INVESTIGATION OF REGOLITH EVOLUTION THROUGH A PETROGRAPHIC AND ELECTRONPROBE ANALYSIS OF SOIL SAMPLES
A. BASU, Indiana University, Graduate School, *2805 E. 10th, Bloomington, Indiana* 47401 (NSG 9072)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0017, THE STRATOSPHERIC WATER VAPOR SINK IN THE WINTER ANTARCTIC
J.L. STANFORD, Iowa State Univ. of Sc. & Tech, School of Hum. & Sciences, Physics, *Beardshear Hall, Ames, Iowa* 50010 (ATM76-15403 A02)

The processes by which water vapor is removed from the stratosphere are not well understood. The most promising candidate among these processes is a mechanism operating in the winter antarctic. However, the magnitude of this antarctic sink is in doubt by at least a factor of ten.

This research will utilize satellite-derived temperature information for the southern polar stratosphere in winter. These data will be used to calculate the maximum (saturation) amounts of water vapor which can be held by the cold stratospheric air, as a function of pressure (altitude), geographical position, and time. The difference between these amounts and the generally accepted value for stratospheric water vapor content will be calculated and assumed to form precipitation particles. The stratospheric water mass removed is the total mass of these particles which are able to fall out of the stratosphere before evaporating in the warming air at the end of winter.

A second phase will refine the calculations by incorporating the effects of air circulation into and around the strong polar-night vortex and the effects of asymmetry of the cold air masses around the South Pole. A third phase of the research will utilize satellite radiance data from several years to determine the year-to-year variability of the stratospheric temperature structure in winter, allowing an estimate of the amount of water removed from the stratosphere during an 'average' year.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0018, AIRBORNE RESISTIVITY TECHNIQUES FOR LOCATING CONSTRUCTION MATERIAL
J. EVERETT, Earth Satellite Corporation, *7222 47th St., Bethesda, Maryland* 20015 (153599 (HRB NO.))

Airborne resistivity survey techniques are being tested over five sites in glaciated terrain to find buried sand and gravel deposits. These sites average over 50 aquare miles in size, range from Maine to Minnesota and present a variety of geological environments in which suitable construction aggregate is in short supply.

SUPPORTED BY U.S. Dept. of Transportation, Federal Highway Admin.

5.0019, MEASUREMENT OF THE NEAR UV SOLAR FLUX
D.E. BEDO, U.S. Air Force, Geophysics Laboratory, *L.G. Hanscom A.F.B., L.G. Hanscom A.F.B., Bedford, Massachusetts* 01730 (DF581270)

AF function - vehicle tracking during flight and reentry, trajectory prediction, interception, communications. Deficiency - insufficient data on solar irradiance levels to allow accurate modeling of the photochemistry and the compositional structure of the middle atmosphere and stratosphere and to allow predic-

tion of the response of these regions of the atmosphere to temporal changes in the solar input. Objective - the determination of precise values for the absolute spectral irradiance for radiation emitted by the full solar disk at wavelengths between 1,300 and 3,500 angstroms with a spectral resolution of 0.1 angstrom. How research contributes - provides direct measurement of the major source of energy which is input to the earth's atmosphere at nonpolar latitudes. Such information is required for the development of models involving atmospheric heating, photochemical reactions and charged particle production.

Solar irradiance data are acquired from rocket-borne instrumentation. Spectrometers of the Ebert type are mounted to biaxial solar pointing controls which maintain the instrument axis on the solar vector with an accuracy of better than one arc minute. The spectrometer step-scans the spectral region of interest with at least four steps per resolution element and the step position and intensity data are continuously telemetered to the ground. Instrument recovery is routinely attempted but is not required for data return. Prior to flight all instrumentation is calibrated at AFGL using laboratory monochromators and photometric standards. Individual experiments include rocket flights of the uv spectrometer alone as well as joint flights involving both rocket and balloon instruments, the latter experiment providing differential measurements of the solar flux both above and below the stratospheric ozone layer.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0020, AIR-LAUNCHED BALLOON TECHNIQUES

A.S. CARTEN, U.S. Air Force, Geophysics Laboratory, *L.G. Hanscom A.F.B., L.G. Hanscom A.F.B., Bedford, Massachusetts* 01730 (DF580610)

AF function - advanced balloon systems (surveillance, reconnaissance, communications, environmental research support). Deficiency or opportunity - present vehicles have limited altitude and payload capabilities. Objective - to develop an all-weather operational lighter-than-air (LTA) vehicle or platform to put high-altitude sensors and communications relays on station quickly and on short notice over battle theaters. How research contributes - this work involves in-house studies and investigations leading to the design, fabrication and test of an advanced prototype air-launched balloon system (ALBS). When the goals of this research are achieved it will be possible for the Air Force to deploy and inflate in mid-air, automatically and quickly, LTA platforms capable of supporting payloads of at least 200 lbs for 24 hours at altitudes of 70,000 ft or better. This capability will enhance the effectiveness of Air Force missions whose mode of operation requires the rapid availability of low-cost substitute aerial platforms for communications relays like those presently carried on space satellite systems. TAC ROC 305-75 points up the need for such a substitute and specifically mentions LTA platforms.

The basic design configuration of the cryogenically-inflated ALBS has been worked out under IHWU 66651101, in which scientific balloons were chosen as the primary drop vehicles. Using data from that program, a more sophisticated, aircraft-oriented version of the system will be developed under IHWU 76591101 which will meet the stringent standards required of aircraft-borne equipment. To accomplish this goal the parachute system tested and refined during FY77 at the National Parachute Test Range will be adapted to the new hardened version of the ALBS and subjected to qualification tests at the NPTR in FY78-79. The ALBS balloon design will be modified as required to reflect any needed design improvements identified in the IHWU 66651101 test program. Also, the ALBS cryogenic gas storage and heat storage transfer unit used on that program will be redesigned by NBS, as a single dewar of the required capacity and a model of this design will be procured in FY78 for the planned test series. When the new aircraft-qualified system is assembled it will be launched early in FY79 over the WSMR at the designed operationa (Text Truncated - Exceeds Capacity)

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0021, MEASUREMENT OF TIME DEPENDENT PARAMETERS OF STRATOSPHERIC TURBULENT LAYERS OVER LEVEL TERRAIN

R.E. GOOD, U.S. Air Force, Geophysics Laboratory, *L.G. Hanscom A.F.B., L.G. Hanscom A.F.B., Bedford, Massachusetts* 01730 (DF581150)

AF function - provide data to predict if there is a significant change in the environmental quality of the stratosphere as a result of flight of USAF aircraft and missiles. Deficiency - existing data on stratospheric transport is insufficient to accurately predict changes in stratospheric composition from small perturbations caused by aircraft and missile exhaust products. Objective - conduct and analyze balloon-borne observations of the characteristics of turbulence layers. How research contributes - measurements of the turbulence characteristics over level terrain, away from mountains will be compared to previous measurements over mountains. This data will then be used to derive representative mixing coefficients and stratospheric pollution residence times over the United States. This will result in more precise environmental impact assessment of AF flight operations.

A balloon platform is used to carry a corona turbulence sensor that measures the intensity and spectral characteristics of turbulence layers. The balloon will initially be allowed to rise to 90,000 ft., producing a vertical record of the location of turbulence layers. The balloon will then be forced to descend so to float in a turbulent layer for several hours to observe the time history of the turbulent layer. This will be repeated several times during the estimated ten-hour mission. A total of four balloon flights are planned with launches from Watertown, S. Dakota. Two flights will be made in early March and two flights during the summer to cover the westerly and easterly flow conditions. Additional turbulence data will be obtained with piggyback experiments flown on the BAMM program. A gas tracer payload developed and tested under LDF funds will be refurbished for four flights to obtain turbulence transport data.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0022, NORTHERN LATITUDE PLASMASPHERIC VARIABILITY

J.J. KLOBUCHAR, U.S. Air Force, Geophysics Laboratory, *L.G. Hanscom A.F.B., L.G. Hanscom A.F.B., Bedford, Massachusetts* 01730 (DF580870)

AF function - time delays in satellite navigation detection and tracking systems. Deficiency - the day-to-day variability of the ionosphere and the unknown contribution of the plasmasphere are not adequately represented by current models which have errors of up to 25 percent RMS. The plasmasphere can contribute greatly to this variability. Objective - determine the variability of plasmaspheric electron content in the northern latitudes, its correlation for pairs of stations and the extent to which it can be predicted or associated with other geophysical parameters. How research contributes - the contribution of the plasmasphere to total time delay produced on satellite radar and navigation systems can be large. The unknown behavior of the day-to-day variability of the total time delay is the greatest remaining error source in models of range error used by ADCOM in satellite detection radars and in the single frequency mode of the NAVSTAR/GPS satellite navigation system.

Using data already available from three northern mid-latitude stations, and additional data to be taken at a station near the peak of the equatorial anomaly, the day to day variability of the plasmaspheric electron content will be examined to determine the correlation between pairs of stations. Comparisons will also be made with other geophysical parameters to attempt to find the source of this variability from monthly average behavior.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0023, DISPLACEMENT TECHNIQUES IN SHORT RANGE FORECASTS OF SURFACE WEATHER USING SATELLITE INFORMATION

S.H. MUENCH, U.S. Air Force, Geophysics Laboratory, *L.G. Hanscom A.F.B., L.G. Hanscom A.F.B., Bedford, Massachusetts* 01730 (DF581510)

AF function - weather observing, analysis and forecasting for military operations. Deficiency - lack of adequate information to meet military support requirements. Objective - to evaluate displacement techniques in making short-range local forecasts for periods of one to six hours of surface weather conditions using geosynchronous satellite information. How development contributes - the products of this work unit will enable Air Weather Service to choose an optimum satellite-based forecast technique to satisfy forecast requirements and reduce manpower.

Satellite data for approximately 10 weather episodes will be collected, including storm systems of varying size and intensity. Techniques currently used to determine motion vectors from digital data will be adapted to the satellite data format, and a series of tests will be run to determine their relative accuracy in forecasting changes in cloud parameters. The use of wind information from NWP products will also be tested as a motion vector technique. A procedure will then be developed to forecast probability of cloud cover and precipitation using the best motion vector technique along with algorithms developed in IHWU 66700802. A series of test forecasts will be made and the accuracy of results compared to those based on persistence and on Markov-type techniques.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0024, SHUTTLE INSTRUMENT DEVELOPMENT

M. SMIDDY, U.S. Air Force, Geophysics Laboratory, *L.G. Hanscom A.F.B., L.G. Hanscom A.F.B., Bedford, Massachusetts* 01730 (DF580760)

AF function - surveillance, communications, ionospheric/magnetospheric modelling and shuttle current system. Deficiency - inadequate knowledge of the electrical properties of the ionosphere/magnetosphere system and of the interaction of the space shuttle with the environmental plasma. Objective - to design and fabricate instruments for: 1. Determining shuttle charging and current flow - wake and sheath properties. 2. To measure the flux, directional properties of ions and electrons in the energy range 0 to 50 eV. How research contributes - permits improved space vehicle design for communication and surveillance systems. Provides understanding of the dynamical processes in the ionosphere and magnetosphere and contributes to the understanding and solution of current flow problems on the shuttle.

Spacecraft charging monitors and low-energy plasma monitors will be developed for flight on the space shuttle. Later, low-energy plasma sensors will be designed for sub-satellite flight in the magnetosphere.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0025, ELECTRON ESA SATELLITE 78-1

R.P. VANCOUR, U.S. Air Force, Geophysics Laboratory, *L.G. Hanscom A.F.B., L.G. Hanscom A.F.B., Bedford, Massachusetts* 01730 (DF581000)

AF function - navigation, communication and surveillance. Deficiency - disruptions in high latitude and HF communication systems and anomalous operation of space systems during magnetic disturbed conditions. Objective - to launch electron electrostatic analyzer detectors into polar sun-synchronous orbit to determine electron characteristics during disturbed times in the auroral oval. How research contributes - improved models of particle and current systems will result in improved predictions of time and amplitude of magnetic disturbances.

Two electron electrostatic analyzers (90 degrees apart) will be integrated and launched on AF Satellite P78-1 into a circular polar sun-synchronous orbit (600 km). Data will be acquired in the auroral oval during normal and magnetically disturbed conditions, particularly, during magnetic storms.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0026, GRAVITY CORRELATION STUDY

M.C. ROUFOSSE, Smithsonian Institution, *60 Garden St., Cambridge, Massachusetts* 02138 (DF580170; F19628-78-C-0003)

AF function - missile siting, targeting and delivery. Deficiency or opportunity - existing gravity incomplete and inadequate. Objective - establish correlation between lateral inhomogeneities in earth's upper mantle and gravity anomalies. How research contributes - will provide quantitative predictors of the earth's gravity field.

Conduct qualitative and quantitative study of lateral inhomogeneities in upper mantle composition and density using observed and calculated free-air anomalies topographic heights, as well as satellite altimetry, seismic velocities and heat flow values.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0027, LASER SPECTROSCOPY STUDY

R. ENG, Laser Analytics Incorporated, *38 Hartwell Ave., Lexington, Massachusetts* 02173 (DF248490; F19628-77-C-0015)

AF function - defense satellite program, infrared backgrounds, atmospheric laser transmission. Deficiency - the absorption of radiation in the atmosphere in the window regions is poorly understood and is a limitation on IR imaging systems, target detection, and laser transmission. Objective - by making high-resolution spectral measurements in the frequency regions of low absorption under a wide range of pressures, temperatures, and absorber amounts, the origins and experimental evidence for absorption in this region will be determined. Tunable diode lasers will be used. How research contributes - the results of this research will have direct applicability to the continuum and weak line transitions contained in the AFGL modeling codes.

Tunable laser spectroscopy will be performed in the atmospheric window regions.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0028, HIGH-POWER RADAR STUDIES OF TRANSPORT BETWEEN THE TROPOSPHERE AND STRATOSPHERE

J.V. EVANS, Mass. Inst. of Technology, Lincoln Laboratory, *244 Wood St., Lexington, Massachusetts* 02173 (ATM77-12916)

This grant funds a program study of tropospheric and stratopheric winds and turbulence. The measurements use the UHF fully steerable ground-based radar system being assembled at Millstone Hill, Massachusetts. It is anticipated that these measurements will yield horizontal wind velocity (to an accuracy of 2-3 m/sec) and mean vertical motion (to 3-5 cm/sec) over the height interval 5 to 24 km approximately, for periods of 24 hours twice per month for one year. The time resolution between independent measurements should be of the order of 10 minutes and the height resolution better than 1 km. Some measurements with even finer resolution with also be conducted albeit over more limited height intervals. A period of nine (9) months to develop the experimental capability will precede the year of data gathering and a 3-month interval of data analysis and report writing will follow.

The objective of the program is to develop improved models for the vertical transport of trace constituents into the stratosphere, by exploring the large-scale vertical air motions associated with the jet stream, and measuring the intensity of turbulence that gives rise to small-scale eddy-mixing.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0029, SATELLITE/SPACE PLASMA INTERACTION STUDY

U. SAMIR, Univ. of Michigan, School of Engineering, Electrical & Computer Engin, *Ann Arbor, Michigan* 48106 (DF581800; F19628-78-C-0046)

AF function - communication, ionosphere and magnetosphere modelling, spacecraft charging mechanisms. Objective - to determine the structure of a satellite sheath and perform a parametric study relating satellite velocity, altitude, ambient plasma density, temperature, and energy. How research contributes - defines and quantifies spacecraft sheath and charging properties enabling the effects on communications equipment and sensing systems to be evaluated.

A phenomenological study of problems involved in spacecraft-space plasma interactions will be made by utilizing in situ measurements made aboard Air Force satellites including the S3-2 and DMSP, block 5D.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Geophysics Lab.

5.0030, MEASUREMENTS OF DIFFERENTIAL CROSS SECTION OF SECONDARY ELECTRONS EJECTED FROM ATMOSPHERIC GASES BY ELECTRON IMPACT
T.W. SHYN, Univ. of Michigan, School of Engineering, Atmospheric & Ocean Science, *Ann Arbor, Michigan* 48106 (ATM77-27215)

This grant funds an experimental investigation of the secondary electrons ejected from atmospheric gases (N2, O2, CO2, H2 and NO) by electron impact. Reliable experimental data on the angular and energy distribution of secondary electrons are required to understand the energy transfer pocesses in the upper atmosphere and to calculate the overall energy budget in the atmosphere.

A crossed-beam technique is employed to measure the angular and energy distribution of secondary electrons, with particular emphasis on low-energy distribution of secondary electrons. The energy range of the secondary electrons measured is from one half of the incident electron energy down to 1 eV and the anglar range from near 0 degrees to 160 degrees. Many different incident energies from the threshold energy to 2 keV will be used.

Experimental data are analyzed through a graphical method based on the Platzman-plot. The Platzman-plot is used to normalize the energy distribution of secondary electrons to a well-known ionization cross section and also to check the data for consistency with available photoionization cross sections. A Fano-plot of the data is used to check consistency of our data in its incident energy dependence. For high incident energies where the Born approximation is valid, optical oscillator strengths can be derived from the slope in the Fano-plot.

SUPPORTED BY U.S. National Science Foundation, Div. of Atmospheric Sciences

5.0031, COMPREHENSIVE RESOURCE INVENTORY AND EVALUATION SYSTEM (CRIES)
R.D. VLASIN, Michigan State University, Agric. Experiment Station, Resource Development, *New Administration Bldg., East Lansing, Michigan* 48823 (0074507; MICL01285H)

OBJECTIVES: Develop an overall analytical framework for assessing agricultural planning options for LDC's. Develop appropriate training materials for transfer of methodologies. Develop technique for creating geographic computer-based information. Develop linear programming models for LDC's. Develop information system for large-area agricultural analysis.

APPROACH: Secure relevant economic data on agricultural sector of LDC's. Develop appropriate data for geographic information system (country-wide). Develop data for agricultural data information system. Obtain land use data (if necessary) from advanced remote sensing technology. Develop analytical model (linear program) for policy analyses. Involve in-country counterparts in all phases of study and training.

SUPPORTED BY U.S. Dept. of Agriculture

5.0032, ANALYSIS OF LONG-TERM DENSITY VARIATIONS OF ATOMIC NITROGEN
M.J. ENGEBRETSON, Augsburg College, Undergraduate School, *731 21st. Ave. S., Minneapolis, Minnesota* 55404 (NSG 5285)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0033, COLLABORATIVE RESEARCH ON DEVELOPMENT OF FABRIC AND FOLIATION IN THE BARNES ICE CAP, BAFFIN ISLAND, CANADA
P.J. HUDLESTON, Univ. of Minnesota, School of Earth Sciences, Geology & Geophysics, *105 Morrill Hall, Minneapolis, Minnesota* 55455 (EAR77-12990)

This project involves a study of development of fabric, foliation, and associated structures in the margin of the Barnes Ice Cap on Baffin Island. The structures to be examined are in a wedge of superimposed ice, formed by the freezing of meltwater from snow in the ablation zone, that has been preserved and overridden by older Pleistocene ice of the main glacier. Exposures in existing shaft and tunnel show that most of the deformed superimposed ice available to observation contains a simple foliated or layered structure. Ice near the margin contains three structural elements with strikes parallel to flow lines but discordant dips or plunges. These include bandings marked by variations in bubble content, by preferred orientation of elongated air bubbles, and by zones of shear a few centimeters thick that alternate with thin bands of weakly deformed ice. The transition from the pattern of simple foliation to that of complex structure will be examined by excavation of an additional shaft, with drifts as necessary.

A simple shear apparatus will be used to measure creep rates in samples of the glacier ice to determine the dependence of creep rates on grain size and crystallographic orientation of ice crystals.

SUPPORTED BY U.S. National Science Foundation, Div. of Earth Sciences

5.0034, ASSESSMENT OF WATER QUALITY STATUS AND TRENDS IN MINNESOTA BY REMOTE SENSING
A.C. MACE, Univ. of Minnesota, School of Forestry, Forest Biology, *105 Morrill Hall, Minneapolis, Minnesota* 55101 (A033MINN)

SUPPORTED BY U.S. Dept. of the Interior, Office of Water Research & Technology

5.0035, REMOTE SENSING APPLICATIONS TO FOREST, WATER AND RANGELAND RESOURCE MANAGEMENT
M.P. MEYER, Univ. of Minnesota, School of Forestry, Forest Resources, *301 Green Hall, St. Paul, Minnesota* 55108 (0023512; MIN-42-037)

OBJECTIVE: Significantly improve the data-gathering and analysis capabilities of research scientists, planners and managers in forest, water and rangeland resources development fields.

APPROACH: Definition of the problem; final selection on basis of need and potential for ultimate application to greatest number of users and/or resource values (relative cost-effectiveness). Design of project - accomplished, insofar as possible, in cooperation with interested, potential users - equipment package, timing selection of vegetation stage, overflight plan, coordination with ground cooperators, ground-truth needs definition and plans for collection and final analysis. Overflights/ground truth. Image interpretation; image enhancement/analysis where appropriate. Data analysis. Review with, and possible assistance to adaptation by, the Cooperator-Users. Report/Publication.

PROGRESS: A portable field viewer for 9 X 9 CIR transparencies was developed and tested by USDA-SCS field personnel. Continuing tests of 35mm aerial photography for waterfowl census suggest CIR at 1:8,000 or larger will be adequate to identify snow, blue and Canada geese. An analysis of current and past 1939-1974 aerial photography and past treatments of a large portion of the Superior National Forest is being completed and related to the status of certain wildlife populations. Successful pilot tests were made of CIR 35mm aerial photography for survey of dwarf mistletoe in black spruce and sale preparation and management of these infected stands. Fall 35mm aerial photography proved economical and highly useful in the inventory of maturing pine plantations and the formulation of treatment plans including mechanical harvest scheme design. Similar photography was successfully tested as a means of identifying and classifying paper birch stands for intensive management. A remote sensing applications work plan and operational manual for the Minnesota DNR is in progress.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Minnesota

5.0036, MEASUREMENTS OF ICE NUCLEUS CONCENTRATIONS IN TITAN ROCKET EXHAUST CLOUDS(II)
G.G. LALA, State University of New York, Atmospheric Sciences Res. Ctr., *41 State St., Albany, New York* 12203 (NAS 9-15538)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0037, PETROGENESIS OF CHONDRULES AND CHONDRITES
UNKNOWN, Columbia University, Graduate School, *109 Low Memorial Library, New York, New York* 10027 (NSG 7466)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0038, SEQUENTIAL DECODER FOR PIONEER VENUS REVERSE PLAYBACK TELEMETRY
UNKNOWN, Rensselaer Polytechnic Inst., Graduate School, *110 8TH, Troy, New York* 12181 (NAS 2-10006)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0039, SUPPORT OF NINTH GEODESY SOLID EARTH AND OCEAN PHYSICS
UNKNOWN, Ohio State University, Graduate School, *190 N. Oval Dr., 102 Administration Bldg., Columbus, Ohio* 43210 (NASW 3194)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0040, SPACE AND TIME VARIABILITY IN THE UPPER ATMOSPHERE
N. ENGLER, Univ. of Dayton, Res. Inst., *300 College Park Ave., Dayton, Ohio* 45409 (DA0F1767; DAAD07-78-C-0020)

Analyze rocketsonde data to determine and space variability of upper atmospheric density, temperature, pressure and winds, and remove observed biases from ballistic sphere program, study gravity waves in ROBIN sphere data, design field experiments for improving analysis capability. (External effort supporting DA of 1768.)

Contractor will conduct a literature search concerning variability of the upper atmosphere in the tropics. A data base will be assembled consisting of all datasonde, spheres, and other soundings that lend themselves to temporal and spatial analysis. Emphasis will be placed on variations that are larger than the particular sensor used in collecting the data. In addition, the ROBIN 77 computer program will be tested for accuracy. This program will be used to study possible vertical motions in past data sets already available at UDRI. Under a previous contract a ballistic sphere program was developed and tested. Biases were detected; the source will be investigated and removed. A diurnal launch series of sphere firings will be analyzed for the presence of gravity waves.

SUPPORTED BY U.S. Dept. of Defense, Electronics Research & Development Command, Atmospheric Sciences Lab.

5.0041, SPATIAL AND TEMPORAL VARIATIONS IN ATMOSPHERIC CARBON CONCENTRATION
UNKNOWN, Oregon Grad. Ctr., Graduate School, *19600 N.W. Walker Rd., Beaverton, Oregon* 97005 (NSG 7457)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0042, INTERDISCIPLINARY APPLICATIONS AND INTERPRETATIONS OF REMOTELY SENSED DATA
G.W. PETERSEN, Penn. State University, Agric. Experiment Station, Agronomy, *201 Shields Bldg., University Park, Pennsylvania* 16802 (0061072; PEN01998)

OBJECTIVE: Develop a background in processing and interpretation of the type of data that will be available from the two Earth Resources Technology Satellites and Earth Resources Experimental Package on SKYLAB.

APPROACH: Data interpretation and analysis will be conducted ranging from photointerpretation to various forms of computer processing. Initially this will involve nine bands of multispectral scan imaging data covering 0.38 to 1.0 microns and one band of infrared imaging data covering 8 to 13 micron along with a 70 mm tracking color stereo photo set. The flight line is one for which extensive ground truth is readily available and which contains wide variations in vegetation, soils and geological formations.

PROGRESS: Through the Office for Remote Sensing of Earth Resources 'ORSER', The Pennsylvania State University has been involved in analyzing Landsat-1 data. Combining various imagery analysis techniques and programs, ORSER has developed a sophisticated processing system for the analysis of satellite and aircraft collected data. A system for regional land cover mapping in Pennsylvania was developed using Landsat-1 multispectral scanner 'MSS' data. Land cover maps were produced on a watershed basis for a 7,700 square kilometers area within the Susquehanna River Basin. Major land cover types delineated included bare soil, stubble-land, hayland/grass, woodland, urban areas, disturbed land, and water bodies. These land cover types were classified with a 75 percent correct classification. The principal source of ground truth and verification information were USGS 7.5 minute quadrangle maps and aircraft photography. To minimize cost and time in development of these maps, the spectral signatures used in classifying the MSS data were transferred into adjacent watersheds. Signatures transferred in time and space correctly mapped land cover types when spatial information and atmospheric components remained relatively constant.

SUPPORTED BY U.S. Dept. of Agriculture, Cooperative State Research Service, Pennsylvania

5.0043, SOIL MOISTURE DETERMINATION STUDY
B.J. BLANCHARD, Texas A & M University System, School of Engineering, Agricultural Engineering, *P.O. Box F E 44, College Station, Texas* 77843 (NAS 5-25144)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0044, LUNAR SAMPLE ANALYSIS
E.C. CHAO, U.S. Dept. of The Interior, Geological Survey, Geologic Division, *12201 Sunrise Valley Dr., Herndon, Virginia* 22092 (9580-00761)

The overall objective of this project has been the determination and description of the major lunar breccia types and their origins in the pre-mare history of the moon. Interdisciplinary consortium investigations on carefully correlated subsamples and particular lithologies have been found in the study of hand-specimen-size complex lunar breccias. E.C.T. Chao has served as the leader of consortium studies on the Apollo 17 station 7 boulder and the Apollo 16 white-matrix boulder. The activities of this project will terminate the current year with completion of a final report summarizing the Apollo 17 station 7 boulder consortium results.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0045, PLANETARY MINERALOGY
P. TOULMIN, U.S. Dept. of The Interior, Geological Survey, Geologic Division, *12201 Sunrise Valley Dr., Herndon, Virginia* 22092 (9710-00954)

The project is concerned with mineralogical studies of extraterrestrial planetary bodies by theoretical and remote analytical methods. Principal emphasis is on the analysis of Martian surface materials by means of two instruments on the Viking Mars Landers: an X-ray fluorescence spectrometer for elemental analysis of surface samples, and a gas chromatograph-mass spectrometer; the latter, in addition to its primary applications to the organic analysis of the Martian 'soil' and the analysis (by MS alone) of the Martian surface atmosphere, has provided useful data on volatile inorganic constituents of the Martian surface. Laboratory simulations will be an important activity in FY 78. Active operations of the X-ray fluorescence spectrometer on Mars continues.

SUPPORTED BY U.S. Dept. of the Interior, Geological Survey, Geologic Div.

5.0046, GEOPHYSICAL ANALYSIS OF COHERENT SATELLITE SCINTILLATION DATA
E.J. FREMOUW, Physical Dynamics Incorporated, *P.O. Box 21589, Seattle, Washington* 21589 (DF050590; F49620-78-C-0014)

AF function - satellite communications, deep-space surveillance and global positioning from satellite signals are all affected by scintillation due to the ionosphere. Deficiency - DNA and AFGL are investigating signal statistics due to ionospheric irregularities. However, to adequately understand, model and forecast the scintillations, their morphology and correlation with geophysical occurrences, as particle precipitation, needs to be accomplished. Objective - determine the morphology of subauroral scintillation and correlate their occurrence and relationships with the auroral electrojet, discrete auroral arcs, and particle precipitation. Contribution - an increase in the understanding of the physics of scintillations and possible insight into modelling is expected.

To analyze the VHF intensity and phase indexes from the DNA P76-5 satellite over Poker Flats, Alaska. Other geophysical information will be gathered and correlated with the scintillation data. Possible seasonal trends and the location and motion of the subauroral scintillation boundary will be investigated as will the relationships between scintillations and other observable phenomena.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

5.0047, ATMOSPHERIC CLOUD PHYSICS LABORATORY GAS SCAVENGING EXPERIMENT
P.V. HOBBS, Univ. of Washington, School of Arts & Sciences, Atmospheric Science, *C301 Health Sciences Bldg., Seattle, Washington* 98105 (NAS 8-33148)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0048, HYDROLOGY STUDY ON ARCTIC COASTAL PLAIN OF ALASKA
UNKNOWN, Univ. of Washington, Graduate School, *C301 Health Sciences Bldg., Seattle, Washington* 98105 (NAS 5-25125)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

5.0049, GEOPHYSICAL INVESTIGATION OF THE 'DOME C' AREA, EAST ANTARCTICA
C.R. BENTLEY, Univ. of Wisconsin, School of Letters & Science, Geology & Geophysics, *500 Lincoln Dr., Madison, Wisconsin* 53706 (DPP77-22318)

For several years, 'Dome C' in East Antarctica (74 degrees, 30 minutes S, 123 degrees 10 minutes E) has been designated as a region of primary research interest to the International Antarctic Glaciological Project (IAGP). It serves as focal point for glaciological traverses in several directions being carried out by the IAGP countries, and it was also selected as having probability of being the best spot to carry out deep drilling through the ice sheet. Drilling to intermediate depths would also be important.

In preparation for this deep drilling, geophysical measurements on and around Dome C is proposed. The program will be integrated with surface glaciological measurements proposed by Ohio State University for the same field season. Geophysical observations would include radar soundings of ice thickness and internal layering, electromagnetic and seismic polarization and wave velocity determinations aimed at revealing anisotropy, electrical resistivity, studies of temperature and deep ice structure, and examination of subglacial structure by seismic refraction and gravity techniques.

SUPPORTED BY U.S. National Science Foundation, Div. of Polar Programs

5.0050, TECHNICAL SUPPORT TO THE FIRST GARP GLOBAL EXPERIMENT SPECIAL EFFORT
V.E. SUOMI, Univ. of Wisconsin, School of Letters & Science, Meteorology, *500 Lincoln Dr., Madison, Wisconsin* 53706 (NAS 5-25148)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, MORPHOMETRICS OF CELLULAR DAMAGE IN MICE RECEIVING WHOLE BODY IRRADIATION
W.J. SAPP, Tuskegee Institute, School of Arts & Sciences, Biology, *Tuskegee Institute, Alabama* 36088 (NSG 2330)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0002, DEVELOPMENT AND EVALUATION OF ADVANCED INSTRUCTIONAL FEATURES AND METHODS IN ASPT
R. HUGHES, U.S. Air Force, Human Resources Laboratory, *Williams A.F.B., Chandler, Arizona* 85224 (DF224020)

1. To develop through active experimental manipulation effective applications of ASPT advanced instructional features to air-to-surface training. 2. To identify factors affecting the effective management of ASPT advanced instructional features within the context of A-10 air-to-surface training. 3. To develop and evaluate candidate measures of instructional effectiveness.

Two phases are proposed. Phase I is a developmental phase in which a series of mini-studies will be conducted to identify promising applications of ASPT instructional features in the training of air-to-surface attack skills on the A-10. The emphasis in Phase II represents a shift in focus from the student to the instructor and the manner in which the instructor is able to utilize the instructional features as an aid to training. A chief concern in Phase II will be upon the instructor's allocation of instructional time and practice time and the effects of such allocation upon student performance. Measures of effectiveness such as performance gain per unit of instructional time will be evaluated for their sensitivity to different strategies of employing advanced instructional features.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0003, COMPARATIVE ANALYSIS OF CENTRAL VS DISTRIBUTED COMPUTER SYSTEMS AS APPLIED TO THE ASPT FLIGHT SIMULATION
T.K. TEMPLETON, U.S. Air Force, Human Resources Laboratory, *Williams A.F.B., Chandler, Arizona* 85224 (DF223770)

Develop criteria to analyze alternate computer system configurations (central vs distributed) as they apply to flight simulators. This will serve as a design tool in the acquisition of future simulator systems.

ASPT is currently undergoing a major configuration update through the replacement of a single SEL 86 computer with three SEL 32/55's. The functions performed by each of these systems is essentially the same, i.e., flight simulation for two T-37 cockpits. This provides the opportunity to do an in-depth comparative analysis of central vs distributed computer systems. The areas to be examined include CPU utilization, core requirements, software efficiency, system flexibility, cost, and ability to perform required task.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Human Resources Lab.

6.0004, ISOLATION OF CIRCULATORY INFLUENCE IN HSG

R.E. BURGER, Univ. of California, School of Agric. & Envir. Sci., Avian Science, *Davis*, *California* 95616 (DF049870; AFAFOSR-3430-77)

AF function - the Air Force operational environment involves exposure to a wide variety of mechanical forces including high sustained acceleration (HSG). It has been recognized that cardiovascular responses can be encountered which may be particularly important in determining performance capabilities in aircrew members. Deficiency - exposure to high sustained acceleration (HSG) produces myocardial pathologies in small mammals. Both subendocardial hemorrhages and cardiac myopathies have been observed in swine subjected to acceleration stress. Recently, similar pathologies have been discovered in avian species, suggesting an interspecies response and providing an excellent model for study. The possibility exists that man subjected to extreme acceleration stresses, as in the new maneuverable fighter planes, may be developing similar cardiac myopathies. The cause of these damages deserves investigation. Objective - this study will evaluate the component of arterial hypoxia in susceptibility to HSG, using domestic fowl as subjects. One can artifically maintain oxygenation via a catheter inserted into the air sac, a procedure that is not compatible with the thoracic respiratory system of mammals. This procedure removes ventilatory impairment as a factor determining response to HSG. How research contributes - this research will complement ongoing exploratory work at USAFSAM dealing with the effects of HSG on the cardiovascular system, with emphasis on 'g' induced cardiomyopathy. It directly supports subarea 1.6, 'Aircrew Safety and Effectiveness in Mechanical Force Environments'.

Estimate oxygen metabolism as a measure of circulatory impairment and potential myocardial susceptibility to HSG, calculate mixed venous oxygen concentration to aid in assessing perfusion abnormalities, determine RQ which will indicate the presence of absence ventilation perfusion inequalities, and estimate the contribution of arterial hypoxia on myocardial pathology.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Office of Scientific Research

6.0005, COMPARISON OF STRESS RESPONSES IN MALE AND FEMALE CADETS

O. SAMPSON, U.S. Air Force, Chemistry & Biol. Sci. Dept., *A.F. Acad., Colorado Springs, Colorado* 80840 (DF282220)

AF function - technology base - determination of stress responses in cadets. Deficiency - no data on females and no comparison between males and females in terms of acclimatization to stresses of altitude and the Academy program. Research - an analysis of physical and physiological variables to document and understand how male and female cadets adapt to life at the Air Force Academy. How research contributes - establishes a data base from which norms can be derived. This will serve as a means of establishing base line data for stress acclimatization in AF training environments, especially those influencing entrance standards and Academy training programs.

A five-year longitudinal study is proposed which will include biochemical, anthropometric and physiological tests which will provide data to document the acclimatization of 200 male and 200 female cadets to the stresses of medium altitude and the demanding training program of the United States Air Force Academy. The data collected will serve to establish an information base for future research and provide a basis for modifying training and selection criteria where necessary.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Frank J. Seiler Research Lab.

6.0006, OPTIMIZATION OF AGRICULTURAL PRODUCTIVITY IN CLOSED ECOLOGICAL LIFE SUPPORT SYSTEMS

J.M. JOSHI, Univ. of Maryland, Undergraduate School, *Princess Anne, Maryland* 21853 (NSG 7470)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0007, TRACKING TASK DEVELOPMENT

W. LEVINSON, Bolt Beranek & Newman Inc., *50 Moulton St., Cambridge, Massachusetts* 02138 (DF323010; F33615-77-C-0522)

To develop, instrument, and test a compensatory tracking task which will have wide applicability and sensitivity to a number of operator stresses induced either by alteration of the stimulus or by direct interference with the subject. Specific test instrument designs, recommendations, and data on critical parameters affecting task performance will result from this effort. The final results will provide data necessary for constructing a preliminary screening task which can be used to assess the effects of a wide range of visual countermeasures on an operator's ability to track various kinds of targets.

A contract will be initiated which will require the contractor to (1) identify and provide a rationale for factors in tracking behavior which are used in a wide range of stimulus conditions, (2) design an actual test incorporating the kinds of parameters isolated, (3) fabricate a breadboard test in accordance with the above design, (4) carry out a series of several pilot studies designed to provide a preliminary indication of the reliability and validity of the test concept, (5) recommend the course of future developments of the task based on the results of these experiments.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0008, TOXIC HAZARDS RATING OF AIR FORCE NONMETALLIC MATERIALS

D.L. GEIGER, U.S. Air Force, Aerospace Medical Res. Lab., *Wright Patt. A.F.B., Dayton, Ohio* 45433 (DF323780)

To determine the physical and chemical behavior of AF nonmetallic materials, plastic waste and surplus organic compounds under a variety of conditions to ascertain their potential toxicity (when utilized in confined habitable spaces), and to identify the environmental pollution impact from their disposal by incineration. To establish thermal profiles for safe utilization of synthetic polymers in confined, habitable spaces. To identify and quantitate thermal degradation products under pyrolytic and oxidative conditions, and to investigate kinetic parameters for thermal decomposition reactions of nonmetallic materials. To determine the toxicological impact of nonflammable fibrous materials used in Air Force aeronautical systems, during routine service conditions and in emergency crash situations. To perform toxic hazard evaluation of these data as they relate to operational exposure of AF personnel and/or environmental impact of use and disposal of such materials. This work is requested by AFSC laboratories, ASD, SAMSO, and AFLC.

Thermogravimetry is used to study physical and chemical stability as well as thermal degradation reaction rates of af nonmetallic materials. Various heating rates and sample environments are employed. For quantitative determination and identification of individual thermal breakdown products, combinations of the simultaneously performed analytical techniques of thermogravimetry (TG), gas chromatography (GC), and mass spectrometry (MS) (TG/MS, TG/GC/MS) are employed. Pyrolysis studies allowing very fast heating rates are carried out also in combination with gas chromatography and mass spectrometry to supplement degradation data. Additional analytical methods such as direct probe mass spectrometry, cryogenic trapping and infrared spectrometry are used as deemed necessary.

SUPPORTED BY U.S. Dept. of Defense, Air Force, Aerospace Medical Research Labs.

6.0009, PAROTID FLUID ANALYSIS OF BLOOD ANTI-MOTION SICKNESS DRUG LEVELS
J.D. DIGREGORIO, Hahnemann Med. Coll. & Hosp., School of Medicine, Pharmacol, *235 N. 15th St., 6401 New College Bldg., Philadelphia, Pennsylvania* 19102 (NAS 9-15620)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0010, NULL LYMPHOCYTES SEPARATION
J.J. TWOMEY, Baylor College of Medicine, School of Medicine, Medicine, *1200 Moursund Ave., Houston, Texas* 77025 (NAS 9-15669)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0011, STUDY OF THE INFLUENCE OF WEIGHTLESSNESS ON LIGNIFICATION IN DEVELOPING PLANT SEEDLINGS
J.R. COWLES, Univ. of Houston, School of Arts & Sciences, Biology, *3801 Cullen Blvd., Houston, Texas* 77004 (NAS 2-9987)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0012, EVOLUTIONARY RELATIONSHIPS IN THE MICROBIAL WORLD
G.E. FOX, Univ. of Houston, Graduate School, *3801 Cullen Blvd., Houston, Texas* 77004 (NSG 7440)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

6.0013, REITAN VALIDATION
J.L. GREEN, U.S. Air Force, School of Aerospace Med., *Brooks A.F.B., San Antonio, Texas* 78235 (DF321710)

The Halstead-Reitan Neuropsychological Test Battery is a standardized set of subtests administered and scored by a technician. The psychology section, neuropsychiatry branch, has undertaken the design and fabrication of subtest equipment which will permit automated administration and scoring via computer. The objective of this effort is to establish normative data using the automated subtests that can then be used in diagnostic evaluation of aircrew by the Aeromedical Consultation Service. Preliminary work with this test confirmed that published standards or 'norms' for the general population were not completely valid in the highly select (aircrew) population. New standards will refine the definition of normal/abnormal performance in aircrew.

Subjects undergoing evaluation by the Aeromedical Consultation Service who are free of suspected/diagnosed neuropsychiatric disorders will routinely receive the Halstead-Reitan Neuropsychological Test Battery to establish standards for 'normal' subjects. First, this will require validation of the new automated subtests, and second, determination of normal ranges and statistical averages for the USAF aircrew. This will consist of a study previously documented under 7755-04-12, which was closed 30 September 1976. Actual effort will begin upon termination of the engineering phase of the study, documented under work unit 7755-21-06.

SUPPORTED BY U.S. Dept. of Defense, Air Force, School of Aerospace Medicine

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, DESIGN AUTOMATION OF DIGITAL SYSTEMS
UNKNOWN, Univ. of Alabama, Graduate School, *Huntsville, Alabama* 35807 (NAS 8-33096)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0002, APPLICATIONS OF GAUSSIAN COLLOCATION TO THE SOLUTION OF THE COMPRESSIBLE NAVIER-STOKES EQUATIONS
P.M. PRENTER, Colorado State University, School of Natural Sciences, Mathematics, *Fort Collins, Colorado* 80523 (NCA 2-165901)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

7.0003, AN ANALYTIC ARTIFICIAL SATELLITE THEORY
K.T. ALFRIEND, U.S. Navy, Res. Laboratory, *4555 Overlook Ave. S.W., Washington, District of Columbia* 20375 (DN680001)

The long-range objective is to develop an accurate analytic artificial satellite theory. The immediate objective is to develop a partial analytic theory using Vinti's theory as an initial approximation in order to evaluate the feasibility of this approach for the development of a full analytic theory. Such a theory could substantially reduce the costs incurred in the orbit prediction and determination of military satellites.

A partial analytic theory which uses Vinti's solution as the initial approximation and which includes some of the zonal and tesseral harmonics, and lunar and solar perturbations will be developed. This theory will then be compared with other theories to determine the best approach for developing a complete analytic theory. The complete analytic theory will then be developed. To develop the theory the initial approximation will be expressed in a suitable set of canonical variables. The perturbing potential will then be expressed in this set of variables and the method of Lie series will then be used to develop a solution. All algebraic manipulation will be performed on the computer using algebraic manipulation routines.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Research Lab.

7.0004, MEDICAL APPLICATION FOR COMPUTER TECHNOLOGY
F.A. FRESH, State University of Fla. Sys., Graduate School, *205 Wildwood Dr., Tallahassee, Florida* 32306 (NAS 5-25165)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, EXPERIMENTAL RELATIVITY BY DAYTIME ASTROMETRY AT SCLERA
H.A. HILL, Univ. of Arizona, School of Liberal Arts, Physics, *Tucson, Arizona* 85721 (PHY77-08200 A01)

Research will continue on measurements of the low-frequency solar oscillations discovered recently, and on the definition of the sun's edge. In parallel, the daytime tracking of stars and planets will continue, to determine the gravitational deflection of light passing close to the sun.

This work is a continuation of that currently supported under NSF grant PHY75-11190 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0002, PROPERTIES OF CONDUCTION ELECTRONS IN METALS
R.W. STARK, Univ. of Arizona, School of Liberal Arts, Physics, *Tucson, Arizona* 85721 (DMR77-03683 A01)

This research program will be directed to experimental studies of lifetimes and Fermi surface effects for electronic transport in pure or nearly pure metals. The first of these studies relates to experiments on electron quantum states having very long quantum state lifetime in magnesium. The now well understood electron quantum interference effect in magnesium will be used to measure the effect of electron-electron and electron-phonon scattering on the quantum state lifetime. Also, this effect will be used to investigate alloy effects in the concentration (C) range of 0.1 ppm less than C less than 20 ppm. Another ramification of the very long quantum state lifetime for electrons in pure magnesium which will be investigated is Pippard's magnetic band structure generated by magnetic breakdown for critical directions of the magnetic field. The second principal area of research centers around measurements of the de Hass-van Alphen effect in ferromagnetic nickel. The basic measurements of the de Haas-van Alphen spectrum for nickel will be completed in order to determine the complete Fermi surface. Also, the effective cyclotron masses will be determined on this surface. This latter data will be used to determine the two spin densities-of-states for nickel as well as obtain information about the many-body electron magnon renormalization effects.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0003, THEORY FORMULATION AND ANALYSIS SUPPORT FOR THE DYNAMICS EXPLORER (DE) PROJECT
F.V. CORONITI, Univ. of California, Graduate School, *405 Hilgard Ave., Los Angeles, California* 90024 (NAS 5-25039)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0004, HEAO A-2 COSMIC X-RAY EXPERIMENT MISSION SUPPORT AND DATA ANALYSIS SUPPORT
G. GARMIRE, Calif. Inst. of Technology, Graduate School, Physics, *1201 E. California Blvd., Pasadena, California* 91109 (NAS 5-25049)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0005, NUCLEAR PHYSICS RESEARCH AT LOW AND MEDIUM ENERGIES
R.E. ANDERSON, Univ. of Colorado, School of Arts & Sciences, Physics & Astrophysics, *1200 University Ave., Boulder, Colorado* 80302 (EY-76-C-02-0535)

The facilities at the Laboratory for the study of the (3He,n) reaction are unique and a series of important investigations is proposed using the reaction. These include proton pairing studies in the Pb region and near the N equals 82 and Z equals 50 shell closures, as well as other nuclei that are of particular interest such as 90Zr. A variety of charged particle reaction studies are proposed. The role of two-step processes in single neutron and proton transfer reactions will be emphasized this year in contrast to the (p,t) and (3He,t) reactions since finite range coupled channels calculations are not required. The (alpha,p) reaction has been shown to be an excellent tool for locating states with high spin (up to a spin of 11). The reaction not only identifies these states, but also provides spectroscopic factors and a number of studies taking advantage of these features are proposed. The theoretical program is, to a large extent, related to the results from the pion physics experiments now underway at LAMPF. Calculations are also being carried out for high energy (up to about 1 GeV) nucleon-induced reactions such as the (p,d) reaction, where some new and interesting features of the reaction mechanism are called for. There is a continuing theoretical interest in two-step processes and finite range effects in low-energy reactions. The experimental program in medium-energy physics is centered around the HRS and EPICS facilities at LAMPF. The investigation of nucleon transfer reactions at medium energies will continue at Indiana Unversity.

RESULTS: The cyclotron has been used to complete numerous studies of nucleon transfer and charge exchange reactions that provided information on various aspects of the nuclear reaction mechanism and nuclear structure. Data have also been acquired on nucleon and pion reactions at medium energies using the facilities at Indiana and Los Alamos. Theoretical calculations have been completed that relate to the experimental program and computer codes developed for nuclear reactions that are used worldwide.

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0006, SURVEILLANCE - COHERENT SPECTROSCOPY
J.L. HALL, Univ. of Colorado, Joint Inst. for Lab. Astrophy., *1200 University Ave., Boulder, Colorado* 80302 (DN875020; N00014-77-C-0656)

The technical objective of this contract is to investigate coherent optical transient phenomena occurring in atomic systems. This work is important to the Navy because it will provide a more detailed understanding of the interaction of atomic systems with coherent (laser) radiation fields.

The approach will use a high-velocity monoenergetic beam of metastable atoms which is crossed with and traverses through several spatially separated light beams. The resulting interference effects will be carefully analyzed and will provide detailed information on coherent optical transients. This approach is formally equivalent to stationary atom being excited by a light pulse in which the width of the pulse is determined by the transit time of the atom through the light beam. An important advantage of this technique is that pulses of special width, e.g., n pi, can be tailored by proper choice of atomic velocity, laser intensity, and/or beam size.

SUPPORTED BY U.S. Dept. of Defense, Navy, Office of Naval Research

8.0007, TOPICS IN THEORETICAL PLASMA PHYSICS
I.B. BERNSTEIN, Yale University, School of Engineering, Engineering & Applied Science, *206 Elm, New Haven, Connecticut* 06520 (PHY78-08433)

Research in theoretical plasma physics currently supported under NSF grant PHY76-06191 A01 will be continued. The topics to be investigated include the following subjects: (1) The linear geometric optics theory of the relativistic free electron laser will be extended to determine the gains to be expected, taking into account effects such as realistic geometrics, the back reaction of the high-frequency fields on the beam, and the influence of beam electron density fluctuations. (2) The theory of laser initiated plasma diode will be developed so as to determine in self-consistent fashion the electromagnetic fields, and charged particle densities and temperatures, so as to interpret the ongoing experiments and assess the utility of the device for isotope separation. (3) A quasi-linear theory will be developed describing the action of turbulent microfields on quasi-static particle distribution functions f, taking into account special variation of both microfields and f.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0008, INNER-SHELL EXCITATIONS IN HEAVY ION-ATOM COLLISIONS
Q.C. KESSEL, Univ. of Connecticut, Graduate School, Physics, *Storrs, Connecticut* 06268 (PHY78-06723)

A comprehensive experimental study of the excitation of inner electron shells in heavy atoms during high-energy ion-atom collisions will continue. This investigation will shed light on the quasimolecular processes (in particular, curve crossing phenomena) which occur at small internuclear separations. These

small internuclear separations can only be achieved by high-energy collision processes. The techniques which have been applied in the investigations include both coincidence and scattered particle measurements of the inelastic energy loss, the determination of scattered charge states and the measurement of relative cross sections for X-ray emission. New experiments will provide detailed information on the couplings which give rise to diabetic molecular orbitals in very heavy ion-atom collisions. The results will be compared with the model of Fano and Lichten, with extensions of this model by Barat, Lichten, Eichler and co-workers, and with predictions of recent theoretical work by Schmid and Garcia.

This is a continuation of work currently supported by NSF Grant PHY76-10352 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0009, RARE GASES AND OTHER SYSTEMS AT HIGH PRESSURES

W.B. DANIELS, Univ. of Delaware, School of Arts & Sciences, Physics, *Newark, Delaware* 19711 (DMR78-01307)

Thermodynamic, optical and neutron scattering properties of simple condensed phases such as solidified permanent gases, liquid crystals, and orientationally disordered crystals, are studied as functions of temperature and pressure. Condensed permanent gases, such as fluid and solid phases of helium, argon, nitrogen and methane represent the simplest systems extant with respect to intermolecular forces, hence they are the focus of much theoretical study of thermodynamic and dynamic responses. Measurement of these properties, however, has in many cases proved difficult, producing a corresponding paucity of quantitative experimental data. Daniels has developed innovative methods for preparing samples of the condensed permanent gases by growth of crystals at high pressures for study in a constant volume experimental representation permitting extraction of various 'delicate' temperature dependencies which otherwise would be very difficult to measure quantitatively. Another area of study is that of the changeover from 'quantum' fluid or solid behavior to 'classical' behavior in the same systems at higher pressure and temperature. The studies of liquid crystal and plastic crystal phases at high pressures are aimed at clarifying models of these states of matter and reaching otherwise inaccessible polycritical points which lie off of the zero pressure axis. Most fundamentally, these measurements at high pressures contribute to establishing the form of the orientation dependent intermolecular potential by quantitative observation of the way in which characteristic temperatures scale with intermolecular distance.

This is a continuation of work supported under DMR 75-06519. This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0010, PLASMA CHEMISTRY

M.D. SCHEER, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (3160106)

PROJECT OBJECTIVE: Determine the decay of metastables, ions, electrons, and both neutral gas and electron temperatures in the afterglow of pulsed discharges in order to extract the required rate constants.

PROJECT APPROACH: Using atomic absorption spectroscopy and plasma probe techniques, transient metastable electron and ion concentrations, and electron temperatures are measured during the afterglow period of a pulsed electric discharge. The gas temperature is calculated from the gaseous thermal diffusivity properties. These parameters are then used to calculate the bimolecular decay of such metastable species as He (23S).

SUPPORTED BY U.S. Dept. of Commerce, National Bureau of Standards

8.0011, NUCLEAR REACTIONS AND STRUCTURE

R.H. DAVIS, State University of Fla. Sys., School of Arts & Sciences, Physics, *205 Wildwood Dr., Tallahassee, Florida* 32306 (PHY78-11560)

This is a continuation of work presently supported under NSF grant PHY77-08145.

A wide variety of work is proposed in both basic and applied physics. Work will include studies of elastic and inelastic scattering of heavy ions, heavy-ion fusion, reaction mechanisms and heavy-ion resonance phenomena. Some light ion work on back angle resonances and spectroscopy will also be done. Characterization of high spin states also will be studied. Particle-gamma coincidence methods will be used.

Applied work includes the identification of air pollutants, use of electron beams in electrostatic precipitators, and construction of a proton microprobe.

Considerable work on accelerator modification and instrument development will continue.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0012, AN EXPERIMENTAL INVESTIGATION OF 235UF6 FISSION PRODUCED PLASMAS

G.H. MILEY, Univ. of Illinois, School of Engineering, Nuclear Engineering, *Box 4348, Chicago, Illinois* 60680 (NSG 1547)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0013, RADIATION DAMAGE IN SOLIDS

J.S. KOEHLER, Univ. of Illinois, School of Engineering, Physics, *2527 Hydrosystems Lab., Urbana, Illinois* 61801 (EY-76-C-02-1198)

Since we now know the nature of interstitials and atomic vacancies in face-centered cubic metals, we are attempting to understand irradiation-produced defects in hexagonal and in body-centered cubic metals. At present we are irradiating magnesium, zinc and cadmium. We have also obtained pure niobium and vanadium. The strong trapping of interstitials in aluminum by heavy atoms needs a theory. By measuring the electrical resistance and the changes in anomalous x-ray transmission we will try to understand how impurities trap interstitials.

SUPPORTED BY U.S. Dept. of Energy, Unspecified Unit

8.0014, NUCLEAR STRUCTURE AND NUCLEAR PROCESSES AT INTERMEDIATE ENERGIES

R.D. BENT, Indiana University, School of Arts & Sciences, Physics, *Memorial Hall, Bloomington, Indiana* 47401 (PHY76-84033 A01)

The Indiana University Cyclotron Facility provides beams of protons, deuterons, helium ions and lithium ions at energies up to 160 million volts for nuclear structure research. Other beams are being developed. The research is performed by a large community of users from outside the University as well as by a large Indiana University group. Many of the experiments are performed as collaborations between Indiana University scientists and scientists from other institutions.

The research performed is in the area of studies of the properties of nuclear ground states and excited states by means of a wide variety of techniques, using the precisely defined particle beams from the cyclotron and detection devices such as a magnetic spectrometer and solid state detectors. An active program of studies of pion production near threshold is in progress.

This work is a continuation of that conducted under Foundation grant PHY76-84033.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0015, HIGH-ENERGY EXPERIMENTAL PARTICLE PHYSICS

V.E. BARNES, Purdue University, School of Science, Physics, *Executive Bldg., Lafayette, Indiana* 47907 (E(11-1)-1428 Task D)

Experimental research in high-energy particle physics as follows: (1) antineutrino interactions in hydrogen and deuterium in the FNAL 15' bubble chamber with associated muon identifier; (2) neutrino interactions at ANL energies; (3) counter experiments in the Fermilab internal target area; and (4) hadron hybrid bubble chamber experiments involving 50 GeV anti p-p interac-

tions; and involving 270 GeV pi/sup /p and K/sup /p interactions, using downstream particle identifiers. We also propose to complete further publications from the two ANL neutrino experiments, from the first Fermilab antineutrino experiment, from the Fermilab internal target experiment, from an earlier ANL counter experiment, from the 100 GeV pi/sup /p, K/sup /p and pp experiments at Fermilab, and from the Brookhaven counter effort (ARGO). We further propose hardware and software development in support of the above and toward future counter, neutrino, and hybrid bubble chamber experiments at Fermilab.

SUPPORTED BY U.S. Dept. of Energy

8.0016, ELECTRONIC AND VIBRATIONAL SPECTRA OF SOLIDS

A.K. RAMDAS, Purdue University, School of Science, Physics, *Executive Bldg., Lafayette, Indiana* 47907 (DMR77-27248)

Research previously supported by DMR76-04775.

A series of investigations, utilizing Raman and Brillouin scattering and infrared spectroscopy, will be undertaken to study the vibrational spectra of a variety of solids. Some unusual properties of phonons in the center of the Brillouin zone will be studied as well as local modes associated with crystal imperfections such as lithium in silicon and germanium. These investigations will be carried out in the absence and in the presence of uniaxial stress. Also, Brillouin scattering in silicon carbide polytypes will be undertaken.

The research on impurity states will include a study of lithium and lithium-oxygen complexes in silicon and germanium, two electron (hole) excitations of double donors (acceptors), and the electronic Raman effect of defects in silicon.

Also, the electronic and vibrational spectra of semiconductors doped by nuclear transmutation will be investigated.

This is the first year of a 3-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0017, RESEARCH ON ATOMIC HYDROGEN AT CRYOGENIC TEMPERATURES, WITH APPLICATION TO A HYDROGEN MASER FREQUENCY STANDARD

T.J. GREYTAK, Mass. Inst. of Technology, Graduate School, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139 (NSG 1551)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0018, STUDIES OF SUPERCONDUCTING JUNCTIONS IN THE INFRARED AND VISIBLE REGION

A. JAVAN, Mass. Inst. of Technology, School of Science, Physics, 77 *Massachusetts Ave., Cambridge, Massachusetts* 02139

The response of small-area high-speed superconducting junctions has been studied at infrared and visible frequencies and compared to the microwave response. The use of these high-speed junctions as harmonic mixers in the visible region is presently being explored.

SUPPORTED BY Massachusetts Inst. of Technology

8.0019, CMOS RADIATION EFFECTS MEASUREMENT (CREM) EXPERIMENT AND ASSOCIATED GROUND SUPPORT EQUIPMENT (GSE)

G.R. CARIGNAN, Univ. of Michigan, School of Engineering, Electrical & Computer Engin, *Ann Arbor, Michigan* 48106 (NAS 5-25158)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0020, ELECTRONIC PROPERTIES OF METALS, SEMIMETALS, AND ALLOYS DOWN TO ULTRALOW TEMPERATURES

P.A. SCHROEDER, Michigan State University, School of Natural Sciences, Physics, *243 Natural Science Bldg., East Lansing, Michigan* 48824 (DMR78-07892)

This is a continuation of the research program on electron transport properties of metals, alloys and semiconductors previously supported by NSF grant DMR-7501584 A02. While some measurements will be done over a wide temperature range, the main thrust will be in the ultralow temperature region, extending the present low temperature limit of approximately 30mK for resistivity measurements down to approximately 5mK. The other main thrust will be to extend measurements in high magnetic fields from the 1-4K region to the region of approximately 100mK. Also, a precision current comparator will be used in an attempt to reach a precision of 1 in 10 to the 7th power in resistivity measurements. This will permit definitive studies of the controversial temperature-dependent resistivities of the alkali and noble metals and of deviations from Matthiessen's role in aluminum and silver based alloys. Work on thermoelectric effects in noble and alkali metals and in tungsten, palladium and platinum will continue in order to identify processes for ultralow temperature anomalies occurring in several of these. New areas of investigation include: the effect of the crystal electric field and hyperfine coupling on transport behavior; transport properties of amorphous metals and alloys; and electrical response of algae cells.

This is the first year of a three-year continuing grant.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0021, MUON COMPONENT OF COSMIC-RAY SHOWERS AT ENERGIES ABOVE 10 TO THE 17TH POWER EV

J. LINSLEY, Univ. of New Mexico, School of Arts & Sciences, Physics, *University Hill N.E., Albuquerque, New Mexico* 87106 (PHY77-19377)

Precise measurements of the muon component in extensive air showers produced by primary cosmic rays with energies exceeding 10 to the 17th power eV will be conducted by an existing array of 79 large plastic scintillation counters at the University of New Mexico Volcano Ranch Station. The size, direction, and core location of the shower will be derived from a well-tested procedure applied to the scintillator signals while the muon component will be obtained using two large, lead-shielded counters located some distance apart within the array.

Information on the primary cosmic ray composition is of fundamental importance for the interpretation of experiments to study nuclear interactions at extremely high energies and for understanding the astrophysical implications of data on the energy spectrum and arrival directions of cosmic rays in these energy ranges.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0022, CONSTRUCTION OF AN ATOMIC BEAMS APPARATUS

B. BEDERSON, New York University, School of Arts & Sciences, Physics, *421 1ST Ave., New York, New York* 10012 (PHY76-82434 A01)

This grant will supply funds for the construction of a new atomic beams apparatus, which will make possible new atomic collision experiments of a fundamental nature which have hitherto been only marginally feasible, or not feasible at all. The atomic beam recoil technique will be used in order to study electron-atom collisions and obtain absolute cross sections for state-selected reactions.

This work is a continuation of that currently supported under NSF Grant PHY76-82434

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0023, STUDY NUCLEATION AND GROWTH OF IMMISCIBLE PHASES
L.L. LACY, Rensselaer Polytechnic Inst., Graduate School, *110 8TH, Troy, New York* 12181 (NAS 8-33074)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0024, DETERMINATION OF NEUTRON CROSS SECTIONS AND RESONANCE PARAMETERS FOR THE STABLE TELLURIUM ISOTOPES, FOR THALLIUM 205 & FOR THE OSMIUM ISOTOPES
R.R. WINTERS, Denison University, School of Liberal Arts, Physics, *Box 239, Granville, Ohio* 43023 (EY-76-S-02-2696)

Problems with the errors to be assigned to the neutron sensitivity of the Total Energy Detectors at the ORELA capture facility continue to prove troublesome. Even so, the analysis of the tellurium capture cross section data continues and is expected to be completed by the end of the summer 1978.

The neutron capture and total cross sections will be measured and/or analyzed for the osmium isotopes 186, 187, and 188. These cross sections are of importance in the understanding of nucleosynthesis in stellar interiors.

In order to obtain better estimates of the parity assignments for some of the resonances in the 205 Tl plus n reaction, a series of elastic scattering cross section measurements will be made at ORELA using a separated 205 Tl target.

RESULTS: 51V(n,gamma): a) 139 resonances analyzed 2.5-215 keV using the modified least squares fitting code, LSFIT. b) s- and p- wave strength functions measured. c) The radiative widths for the s-wave resonances shown to be very large with wide fluctuations about their means. d) Paper submitted to Phys. Rev. C. 208Pb: a) 24 resonances analyzed and radiative widths determined for 13 of these. b) Two previously unreported resonances at 43.29 and 47.26 keV found. c) Paper published in The Astrophysical Journal 217, 1977.

SUPPORTED BY U.S. Dept. of Energy, Div. of Basic Energy Sciences

8.0025, MAGNETIC RESONANCE STUDIES OF DEFECT BEHAVIOR IN PEROVSKITE AND RUTILE STRUCTURED MATERIALS
L.E. HALLIBURTON, Okla. St. Univ., School of Arts & Sciences, Physics, *Agriculture Hall, Stillwater, Oklahoma* 74075 (DMR77-08465 A01)

This research was previously supported under DMR 73-07656.

The principal goal of this research program is to determine the formation mechanisms and resulting electronic structure of defects in perovskite and rutile structured halides. Specifically, the self-trapped exciton triplet states in KMgF3 and MgF2 will be investigated by combining optical and magnetic resonance techniques. The results of these experiments will provide a better understanding of the photochemical damage process in low-symmetry materials. The second area of investigation will be the magneto optic properties of luminescing Mn2 ion-F center exchange coupled close pairs in KMgF3. Finally, electron-nuclear double resonance (ENDOR) studies of the self-trapped hole and the impurity-associated fluorine interstitial centers in KMgF3 will be continued, as well as extension of this work to an electron spin resonance (ESR) investigation of interstitial centers in RbCaF3.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0026, COLLABORATIVE RESEARCH ON NUCLEAR PHYSICS AT INTERMEDIATE ENERGIES
L.W. SWENSON, Oregon State Higher Educ. Sys., School of Science, Physics, *126 Agriculture Hall, Corvallis, Oregon* 97331 (PHY76-82333 A03)

Experiments will be conducted at the Los Alamos Meson Physics Facility (LAMPF) and at the TRIUMF cyclotron in Vancouver.

At LAMPF, the pion beam will be used to continue studies of particles emitted from the nucleus in coincidence with inelastically scattered pions to try to understand what are the processes which initially occur when pions interact with nuclei. When the high-resolution EPICS spectrometer is completed, studies of elastic and inelastic scattering of positive and negative pions from nuclei will be conducted with special attention to studies of proton and neutron densities in the nuclear surface. Studies of X-rays emitted by muonic atoms will be conducted to obtain information on nuclear shapes in the mass-190 region. A study will be conducted to measure neutrons and protons emitted in muon capture on nuclei; the proton spectra are expected to give information on the importance of charge-exchange processes at medium energies.

At TRIUMF, a variety of experiments will utilize the special features of that accelerator-polarized protons, energy variability and high duty factor. These will include elastic and inelastic scattering of 200-550 MeV protons, proton-proton bremsstrahlung and coincidence studies of muonic atoms.

This work is a continuation of work supported by the Foundation under grant PHY76-82333.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0027, SYNTHETIC APERTURE RADIOMETRY STUDY
UNKNOWN, Univ. of Pennsylvania, Graduate School, *203 Logan Hall, Philadelphia, Pennsylvania* 19101 (NAS 5-25136)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0028, EXCESS FREE CARRIER PLASMAS IN SEMICONDUCTORS BY MEANS OF FAST TRANSIENT INFRARED SPECTROSCOPY
H.J. GERRITSEN, Brown University, Graduate School, Physics, *University Hall, Box 1867, Providence, Rhode Island* 02912 (DMR76-81865 A01)

Dense and non-equilibrium plasmas in semiconductors will be investigated by experimentally using time-resolved spectroscopy. The density of the free carrier plasma generated by picosecond laser pulses of variable intensity will be studied. The time dependence of the plasma density will be measured and related to diffusion and recombination kinetics. The studies will concentrate on germanium and gallium arsenide as the host for the plasma.

SUPPORTED BY U.S. National Science Foundation, Div. of Materials Research

8.0029, ACOUSTIC PROPERTIES OF DUCT LINING MATERIALS
D.T. BLACKSTOCK, Univ. of Texas, School of Engineering, Mech Engin, *200 W. 21st, Austin, Texas* 78712 (NSG 3198)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

8.0030, HIGH-ENERGY PHYSICS RESEARCH
L.W. MO, Virginia Poly. Inst. & St. U., Graduate School, *Burruss Hall, Blacksburg, Virginia* 24061 (PHY77-27521)

This grant will study important questions on both the weak and electromagnetic interactions: I. A study of the purely leptonic reaction neutrino-electron scattering at FNAL is being done to understand better the structure of the weak interaction and to investigate the validity of current theory. II. Completion of the analysis of deep inelastic muon-proton scattering in order to study the applicability of scaling to the reactions.

This work represents a continuation of that currently supported by Foundation grant PHY76-23478 A02.

SUPPORTED BY U.S. National Science Foundation, Div. of Physics

8.0031, OPTICAL PROPERTIES OF AEROSOLS
T.J. PEPIN, Univ. of Wyoming, School of Arts & Sciences, Physics & Astronomy, *P.O. Box 3435, University Station, Laramie, Wyoming* 82071 (DN790032; N00019-77-C-0262)

The objective is to study the attenuation of laser light by spherical particles in the one micron wavelength region.

Develop an optical model for calculating the volume extinction coefficient for an aerosol medium of hollow glass spheres. Experimentally measure refractive index of the aerosol material and their size distribution. Use optical model to optimize size and type of aerosol for the extinction of 1 micron laser radiation.

SUPPORTED BY U.S. Dept. of Defense, Navy, Naval Air Systems Command

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, ORBITING SPACE SCIENCE PLATFORM
S.T. WU, Univ. of Alabama, School of Science & Engin., Mech Engin, *Huntsville, Alabama* 35807 (NAS 8-33132)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0002, MICROMETRIC MEASURES OF VISUAL DOUBLE STARS
F. HOLDEN, Unknown Inst. or Indiv. Grant, 0302 S Market St 95113, *California* (AST77-00249 A01)

Support for an additional years will allow continuation of measures, with bifilar micrometers, of visual double stars in California, Chile, and Venezuela. The 36-inch refractor of Lick Observatory will be again available and, in the northern winter when California does not have its best seeing, measures will be made in Chile and Venezuela. The southern observatories of Cerro Tololo and Las Campanas will be visited and also the C.I.D.A. Observatory near Merida, Venezuela, to extend the observations through both hemispheres of the sky.

Double stars are important because they are more numerous than single stars in our galaxy and from their orbital motions information about stellar masses is obtained.

Previous support was by NSF grant AST 77-00249.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0003, SIMULTANEOUS X-RAY AND OPTICAL OBSERVATIONS
S. BOWYER, Univ. of California, Graduate School, *2200 University Ave., Berkeley, California* 94720 (NSG 5292)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0004, ENGINEERING AND CONSULTING SERVICES FOR SPACE TELESCOPE INSTRUMENT SCIENCE TEAM
UNKNOWN, Univ. of California, Graduate School, *2200 University Ave., Berkeley, California* 94720 (NAS 5-25070)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0005, STABLE FREQUENCY SOURCE UTILIZING A SUPERCONDUCTING-CAVITY-STABILIZED OSCILLATOR
M.H. COHEN, Calif. Inst. of Technology, Graduate School, Astronomy, *1201 E. California Blvd., Pasadena, California* 91109 (AST76-23634)

Very long base line interferometry (VLBI) is the technique in which two radiotelescopes thousands of miles apart can be used together to resolve the finest details of distant radio sources. This is done by recording the signals from the separate telescopes along with timing information from a highly accurate clock and later playing back both tapes into a special processor. The success of the method depends upon the accuracy of the clocks at each telescope. Until now most telescopes have used hydrogen maser time standards which are quite expensive. A new type of standard based on a superconducting cavity stabilized oscillator will be developed for use at the Owens Valley Radio Observatory of the California Institute of Technology which does not have a hydrogen maser. The new standard will greatly improve the stability and sensitivity of VLBI observations made at the observatory and will be available to all qualified users.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0006, MODELS OF THE LUNAR REMANENT FIELD WHICH ARE CONSISTENT WITH APOLLO AND LUNOKHOD DATA
W.A. BARKER, Univ. of Santa Clara, School of Science, Physics, *El Camino Rd., Santa Clara, California* 95053 (NCA 2-685811)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0007, STELLAR PROPER MOTIONS AND PARALLAXES
A.R. KLEMOLA, Univ. of California, Graduate School, Astronomy & Astrophysics, *Santa Cruz, California* 95060 (AST76-81342 A01)

The study of the motions of stars near the sun and the general pattern of rotation about the center of our galaxy represents an important part of modern astronomy. The renewal support here involves the measurement and analysis of proper motions of stars for about 150 fields on the sky lying outside the zone of avoidance (Milky Way). The motions are determined with reference to distant galaxies which have no appreciable motions. The specific goals of the analyses include: (1) Determination of numerical values for the constants of galactic rotation and possible local deviations from the smooth pattern; (2) Study of solar motion (secular parallax); (3) Determination of local systematic corrections to the system of proper motions as defined by the basic modern star catalog AGK3 for the northern sky.

It is proposed also to continue measurement and reduction of selected stars of the general trigonometric parallax program from the 100 fields having available photographic plate material at the Lick Observatory. Other efforts include determination of the positions of globular clusters requested by radio astronomers and the positions of nearly three dozen stars recently identified as radio sources to aid in a study of the radio-astronomical and optical reference systems. The mechanical encoders on the survey machine will be replaced with optical encoders.

Prior support was by NSF grant AST 76-81342.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0008, SOME PROBLEMS IN THE LATE STAGES OF STELLAR EVOLUTION
R.P. KRAFT, Univ. of California, Lick Observatory, Astronomy & Astrophysics, *Santa Cruz, California* 95060 (AST78-08612)

The abundances of iron, carbon and hydrogen will be determined for stars in the extremely metal-poor globular cluster M15 and for the intermediately metal-poor clusters M3 and M13. In addition, these abundances will be determined for a small sample of stars in the dwarf elliptical satellite of our own galaxy, the Draco system. These systems contain some of the oldest stars.

This work will test the hypothesis that material processed by the carbon-nitrogen-oxygen cycle is extensively mixed into the atmospheres of giant stars in globular clusters; it will study whether the carbon-nitrogen-oxygen abundance is the parameter needed to determine the horizontal-branch morphology of globular cluster stars in the Hertzsprung-Russel diagram.

A study of the metal abundances of RR Lyrae stars in selected star fields will be completed in an attempt to determine

the manner in which these abundances vary with distance in the galactic halo.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0009, SOLAR MAGNETIC AND VELOCITY FIELDS
R.F. HOWARD, Carnegie Inst. of Washington, *1530 P St. N.W., Washington, District of Columbia* 20005 (AST77-24752)

Support is for studies of large-scale magnetic and velocity fields on the solar surface to contribute toward an observational basis for an eventual understanding of the dynamo mechanism of the solar activity cycle. The Mount Wilson data covering more than 10 years will be analyzed in an attempt to detect large-scale circulation and the newly discovered meridional flow will be studied in detail. Analysis of the large-scale low-latitude east-west velocities will be pursued. A detailed analysis of the rotation of solar magnetic fields during the activity cycle will be made. The spectrograph, magnetograph, and the scanning and data system will continue to be improved slowly, and aging components will be replaced. Support is also for the continuation and improvement of the synoptic solar observations now being made at the 150-foot Tower Telescope at Mount Wilson.

Prior support was by NSF Grant AST 75-19756 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0010, MEASUREMENT AND ANALYSIS OF VARIABLE PLANETARY AND EXTRAGALACTIC EMISSIONS AT RADIO AND OPTICAL FREQUENCIES
A.G. SMITH, State University of Fla. Sys., School of Arts & Sciences, Physics & Astronomy, *204 Tigert Hall, Gainesville, Florida* 32601 (AST77-24821)

Support is for the continuation of a broadly based study of variable astronomical sources. A major ongoing effort is devoted to long-wavelength radio studies of Jupiter and other outer planets, which are objects of special interest as the focus of recent and future space missions; the coming two-year period will be a crucial one because of the urgency of providing the best possible ground back-up for the two Voyager spacecraft that will make in situ radio measurements of Jupiter in 1979. The primary objective of the program is complete understanding of Jupiter's uniquely powerful radio emissions, a topic of even greater interest since the spacecraft discovery of similar radiation from the earth. A second major ongoing effort involves optical and radio studies of variable extragalactic objects. Here the thrust is toward understanding the processes that produce enormous variable energies in very small regions of quasars and the nuclei of galaxies -- possibly including even 'normal' galaxies such as our own. An adjunct to this program is innovative research on the improvement of photographic technology.

Prior support was by NSF grant AST 76-80830.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0011, COPERNICUS SATELLITE OBSERVATIONS
R.M. CRUTCHER, Univ. of Illinois, School of Liberal Arts & Sci., Astronomy, *Urbana, Illinois* 61801 (NSG 5294)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0012, SOLAR GAMMA-RAY ASTRONOMY RESEARCH
N.S. WALL, Univ. of Maryland, School of Engineering, Physics & Astronomy, *College Park, Maryland* 20740 (NSG 5298)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0013, STUDIES OF THE LOCAL INTERSTELLAR MEDIUM
A.K. DUPREE, Harvard University, School of Arts & Sciences, Astronomy, *16 Divinity Ave., Cambridge, Massachusetts* 02138 (NSG 5293)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0014, ASTROMETRIC INTERFEROMETER
D.H. STAELIN, Mass. Inst. of Technology, School of Engineering, Electrical Engin, *77 Massachusetts Ave., Cambridge, Massachusetts* 02139 (AST77-06052 A01)

Optical stellar interferometry techniques show promise of being able to improve the measurement of stellar positions by a factor of 10 to 15 over conventional techniques. Such an advance greatly increases the chances for detecting neutron stars, black holes, and planets around nearby stars.

An existing pilot model interferometer with a 1.6 meter base line will be improved and the basic system concepts will be demonstrated with observations of bright stars. Basic data about the propagation of starlight through the atmosphere will be obtained. Such data will be necessary for the design of future high-resolution interferometric instruments.

This is a continuation of research previously funded under NSF grant AST 77-06052.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0015, EVALUATE AND ASSESS THE ROLE OF THEORISTS IN SOLAR TERRESTRIAL RESEARCH
R.L. CAROVILLANO, Boston College, School of Arts & Sciences, Physics, *140 Commonwealth, Chestnut Hill, Massachusetts* 02167 (NSG 7468)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0016, INTERIM STUDY REPORT FOR THE PLASMA WAVE RECEIVERS FOR THE SOLAR POLAR MISSION
P.J. KELLOGG, Univ. of Minnesota, School of Liberal Arts, Physics & Astronomy, *322 Johnston Hall, Minneapolis, Minnesota* 55455 (NAS 5-25151)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0017, A STUDY OF STELLAR SURFACE PHENOMENA
B.W. BOPP, Univ. of Toledo, School of Arts & Sciences, Physics & Astronomy, *2801 W. Bancroft St., Toledo, Ohio* 43606 (AST77-09450)

Surface phenomena on our Sun have a variety of forms. Flares, plages, faculae and prominence activity are all localized phenomena, occupying only a small fraction of the solar disc. If we assume our Sun to be a typical star, then obviously other stars must exhibit surface phenomena also. However, for stellar flare activity to be detected, either the level of activity must be considerable higher than that of the Sun, or the background light from the undisturbed stellar photosphere must be low.

This investigation will be a comprehensive examination of stellar surface phenomena, with the objective of obtaining detailed information on the lifetime, development, location, and geometry of stellar active regions. The chromospheric emission lines and the stellar continuum in many stars with a high degree of surface activity will be monitored. In some cases, these observations will be coordinated with far-ultraviolet satellite observations.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0018, COPERNICUS AND BUSS OBSERVATIONS OF AP STARS
M.R. MOLNAR, Univ. of Toledo, School of Arts & Sciences, Physics & Astronomy, *2801 W. Bancroft St., Toledo, Ohio* 43606 (NSG 7475)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0019, THE INTERNAL STRUCTURE OF DENSE INTERSTELLAR CLOUDS
A.N. WITT, Univ. of Toledo, School of Arts & Sciences, Physics & Astronomy, *2801 W. Bancroft St., Toledo, Ohio* 43606 (AST76-81564)

An observational study designed to produce detailed information on the internal structure of dense interstellar clouds will be carried out. The data obtained will lead to significant progress in three areas of importance: 1. The formation of interstellar molecules, particularly the simple species carbon monoxide, formaldehyde, carbon sulfide, ammonia, and hydroxyl radical in interstellar dust clouds. 2. The evolution of interstellar clouds, particularly the phase of initial gravitational collapse. 3. The interaction of gas and dust in the environment of dense interstellar clouds, leading to grain growth and depletion of gaseous components from the cloud. The observational techniques to be employed will vary with the distance, size, density, and galactic locations of a particular dense cloud but will include one or more of the following: 1. Photoelectric u, v, b, y, and H Beta photometry of stars in the line of sight to the cloud as well as in its vicinity. 2. Photographic star counts in several broad photographic bandpasses, including the photographic infrared for very opaque clouds. 3. Photographic photometry in several bandpasses. 4. Surface brightness profile analysis, applicable to very dense nearby clouds or clouds seen at galactic latitudes greater than fifteen degrees.

Telescopes at the National Observatories at Kitt Peak, Arizona and Cerro Tololo, will be used for this purpose. The material will be supplemented with plates from the Palomar Observatory Sky Survey and the European Southern Observatory Atlas of the Southern Sky.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0020, ULTRAVIOLET SPECTROSCOPY OF PECULIAR ECLIPSING BINARY STARS
R.H. KOCH, Univ. of Pennsylvania, School of Arts & Sciences, Astronomy, *34th & Spruce Sts., Philadelphia, Pennsylvania* 19104 (NSG 5296)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0021, BINARY STARS IN THE MILKY WAY AND LARGE MAGELLANIC CLOUD
R.H. KOCH, Univ. of Pennsylvania, Graduate School, Astronomy, *203 Logan Hall, Philadelphia, Pennsylvania* 19101 (AST77-15247)

Support is for research in the following categories: (A) Improvement of eclipse periods for five close binaries which are predicted to show general relativistic rotations of their orbits; (B) The accumulation and analysis of the light curves of close binaries that have been selected because they are neglected or uncommon in some respect; (C) Continued observation of selected close binaries for the linear polarization imposed by their circumstellar matter and chromospheric condensations; (D) A new attempt with better instrumentation to observe the 'ultraviolet excesses' of evolved close binaries; (E) Continued collection of plates of Field I in the Large Magellanic Cloud for the light curves of the close binaries in that field; and (F) A computer simulation of the distribution of binary periods and eccentricities based upon the theories of J.P. Zahn. Item (C) embodies a certain amount of instrumental re-design and fabrication.

Prior support was by NSF grant AST 74-01656 A01.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

10.0022, INFRARED STUDIES OF STARS AND PROTOSTARS IN INTERSTELLAR MOLECULAR CLOUDS
N.J. EVANS, Univ. of Texas, School of Natural Sciences, Astronomy, *200 W. 21st St., Austin, Texas* 78712

SUPPORTED BY Research Corp.

10.0023, STUDY OF FOREBIDDEA LINE EMISSION FROM ABUNDANT HEAVY ELEMENT IONS IN HOT NEBULAE
M. KAFATOS, George Mason University, School of Arts & Sciences, Astronomy, *400 University Dr., Fairfax, Virginia* 22030 (NCA 5-92)

SUPPORTED BY U.S. National Aeronautics & Space Admin., Office of Organization & Management, Office of University Affairs

10.0024, INVESTIGATION OF LOW-INTENSITY OPTICAL EMISSION LINES FROM THE INTERSTELLAR MEDIUM
F.L. ROESLER, Univ. of Wisconsin, School of Natural Sciences, Physics, *Agriculture Hall, Madison, Wisconsin* 53706 (AST77-07840 A01)

A program of observations using a large etalon Fabry-Perot spectrometer to study the spatial structure and ionization state of the faint, diffuse, hydrogen alpha (H alpha) emitting component of the interstellar medium will be carried out. Observations will be made near the directions of O stars that are outside any neutral hydrogen regions visible on the Palomar Sky Survey red plates in order to determine the extent to which such stars ionize the intercloud medium. A study will also be made of an extended region of complex 21-cm filaments, H alpha emission, and soft x-ray emission thought to be associated with a large, expanding supernova-created cavity. Observations of the line widths, radial velocities, and intensity distribution of the H alpha emission from this region will determine the relationship between the H alpha emitting gas and the expanding neutral hydrogen shell. Observations of other emission lines, such as (NII), (OI), and (OIII), will set limits on the temperature and ionization state of the emitting gas in this as well as other regions of the galactic plane.

This action provides additional funding and extends the duration of the grant AST 77-07840.

SUPPORTED BY U.S. National Science Foundation, Div. of Astronomical Sciences

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N79-10997*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TECHNOLOGICAL CHANGE AND PRODUCTIVITY GROWTH IN THE AIR TRANSPORT INDUSTRY
Nathan Rosenberg (Stanford Univ., Calif.), Alexander Thompson (Stanford Univ., Calif.), and Steven E. Belsley Sep. 1978 101 p refs
(NASA-TM-78505; A-7514) Avail: NTIS HC A06/MF A01 CSCL 02A

The progress of the civil air transport industry in the United States was examined in the light of a proposal of Enos who, after examining the growth of the petroleum industry, divided that phenomenon into two phases, the alpha and the beta; that is, the invention, first development and production, and the improvement phase. The civil air transport industry developed along similar lines with the technological progress coming in waves; each wave encompassing several new technological advances while retaining the best of the old ones. At the same time the productivity of the transport aircraft as expressed by the product of the aircraft velocity and the passenger capacity increased sufficiently to allow the direct operating cost in cents per passenger mile to continually decrease with each successive aircraft development. L.S.

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N79-10998*# Lockheed-Georgia Co., Marietta.
IMPROVED SONIC-BOX COMPUTER PROGRAM FOR CALCULATING TRANSONIC AERODYNAMIC LOADS ON OSCILLATING WINGS WITH THICKNESS
S. Y. Ruo Sep. 1978 128 p refs
(Contract NAS1-13613)
(NASA-CR-158906; LG78ER0225) Avail: NTIS HC A07/MF A01 CSCL 01A

A computer program was developed to account approximately for the effects of finite wing thickness in transonic potential flow over an oscillation wing of finite span. The program is based on the original sonic box computer program for planar wing which was extended to account for the effect of wing thickness. Computational efficiency and accuracy were improved and swept trailing edges were accounted for. Account for the nonuniform flow caused by finite thickness was made by application of the local linearization concept with appropriate coordinate transformation. A brief description of each computer routine and the applications of cubic spline and spline surface data fitting techniques used in the program are given, and the method of input was shown in detail. Sample calculations as well as a complete listing of the computer program listing are presented. B.B.

N79-10999*# Lockheed-Georgia Co., Marietta.
SONIC-BOX METHOD EMPLOYING LOCAL MACH NUMBER FOR OSCILLATING WINGS WITH THICKNESS Final Report
S. Y. Ruo Sep. 1978 73 p refs
(Contract NAS1-13613)
(NASA-CR-158907; LG78ER0226) Avail: NTIS HC A04/MF A01 CSCL 01A

A computer program was developed to account approximately for the effects of finite wing thickness in the transonic potential flow over an oscillating wing of finite span. The program is based on the original sonic-box program for planar wing which was previously extended to include the effects of the swept trailing edge and the thickness of the wing. Account for the nonuniform flow caused by finite thickness is made by application of the local linearization concept. The thickness effect, expressed in terms of the local Mach number, is included in the basic solution to replace the coordinate transformation method used in the earlier work. Calculations were made for a delta wing and a rectangular wing performing plunge and pitch oscillations, and the results were compared with those obtained from other methods. An input quide and a complete listing of the computer code are presented. Author

N79-11000*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SUPERSONIC UNSTALLED FLUTTER
J. J. Adamczyk, M. E. Goldstein, and M. J. Hartmann 1978 24 p refs Presented at the 52d Meeting of the Propulsion and Energetics Panel, Cleveland, 23-27 Oct. 1978; sponsored by AGARD
(NASA-TM-79001; E-9785) Avail: NTIS HC A02/MF A01 CSCL 01A

Flutter analyses were developed to predict the onset of supersonic unstalled flutter of a cascade of two-dimensional airfoils. The first of these analyzes the onset of supersonic flutter at low levels of aerodynamic loading (i.e., backpressure), while the second examines the occurrence of supersonic flutter at moderate levels of aerodynamic loading. Both of these analyses are based on the linearized unsteady inviscid equations of gas dynamics to model the flow field surrounding the cascade. These analyses are utilized in a parametric study to show the effects of cascade geometry, inlet Mach number, and backpressure on the onset of single and multi degree of freedom unstalled supersonic flutter. Several of the results are correlated against experimental qualitative observation to validate the models. J.M.S.

N79-11001*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AERODYNAMIC AND ACOUSTIC EFFECTS OF ELIMINATING CORE SWIRL FROM A FULL SCALE 1.6 STAGE PRESSURE RATIO FAN (QF-5A)

Richard P. Woodward, Loren W. Acker, and Edward G. Stakolich Sep. 1978 35 p refs
(NASA-TM-78991; E-9774) Avail: NTIS HC A03/MF A01 CSCL 01A

Fan QF-5A was a modification of fan QF-5 which had an additional core stator and adjusted support struts to turn the core exit flow from a 30 deg swirl to the axial direction. This modification was necessary to eliminate the impingement of the swirling core flow on the axial support pylon of the NASA-Lewis Quiet Fan Facility that caused aerodynamic, acoustic and structural problems with the original fan stage at fan speeds greater than 85 percent of design. The redesigned fan QF-5A did obtain the design bypass ratio with an increased core airflow suggesting that the flow problem was resolved. Acoustically, the redesigned stage showed a low frequency broadband noise reduction compared to the results for fan QF-5 at similar operating conditions. Author

N79-11002# Notre Dame Univ., Ind. Dept. of Aerospace and Mechanical Engineering.
THE INFLUENCE OF AERODYNAMIC INTERFERENCE ON HIGH ANGLE OF ATTACK WIND TUNNEL TESTING Final Report, 1 Apr. 1977 - 31 Mar. 1978
Robert C. Nelson and Thomas N. Mouch Jun. 1978 38 p refs
(Grant AF-AFOSR-3299-77; AF Proj. 2307)
(AD-A056045; AFOSR-78-1079TR) Avail: NTIS HC A03/MF A01 CSCL 02/4

Results from an experimental investigation of strut support interference on high angle of attack aerodynamic measurements are presented. The influence of the strut support on the leeward wake structure was investigated by means of a two-dimensional experiment of a cylinder-splitter plate combination. Pressure distributions, pressure drag coefficient and wake flow visualization data for various cylinder-splitter plate combinations are presented for high subcritical Reynolds numbers. The influence of plate position and size on the pressure drag coefficient were also examined. The results show the splitter plate can alter the vortex wake formation significantly and, as a consequence, reduce the pressure drag coefficient by as much as 30% or more. Plate sizes of 0.5, 1.1 and 1.5 diameter were tested with the 1.1 diameter plate yielding the largest drag reduction.
Author (GRA)

N79-11003# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A NUMERICAL SOLUTION OF SUPERSONIC AND HYPERSONIC VISCOUS FLOW FIELDS AROUND THIN PLANAR DELTA WINGS Ph.D. Thesis
Guion Stewart Bluford, Jr. Jun. 1978 239 p refs
(AF Proj. 2404)
(AD-A056513; AFIT/DS/AA/78S-1) Avail: NTIS HC A11/MF A01 CSCL 20/4

A numerical technique was used to compute the supersonic and hypersonic, viscous flow fields around thin planar delta wings. These solutions were obtained by solving the Navier-Stokes equations subject to a conical approximation. The integration technique used was the MacCormack finite-difference scheme. Solutions were obtained for the upper-only, lower-only, and total flow fields around delta wings with supersonic leading edges. These solutions span a Mach number range of 2.94 to 10.17, a local Reynolds number range of 334,500 to 5,000,000, and various angles of attack from +15 to -15 deg. A stability criteria was developed and used which accounted for both the viscous and inviscid flow regions. Good agreement was obtained between the numerical results and experimental flow field data. The shock-induced vortex within the viscous region and the hypersonic viscous bubble on top of the boundary layer were computed, for the first time. A unique examination was made of the vortical singularities in the conical cross-flow plane of the delta wing. This investigation demonstrated the feasibility of applying the conical approximation to the Navier-Stokes equations in order to solve flow fields around thin delta wings. GRA

N79-11004# AiResearch Mfg. Co., Phoenix, Ariz.
TRANSONIC 3-D FLOW ANALYSIS OF COMPRESSOR CASCADE WITH SPLINTER VANES Final Report, 13 Feb. 1976 - 13 Feb. 1978
P. R. Dodge and L. S. Lieber May 1978 84 p refs
(Contract F33615-76-C-2071; AF Proj. 2307)
(AD-A057504; AiResearch-21-2524-3; AFAPL-TR-78-23) Avail: NTIS HC A05/MF A01 CSCL 20/4

Transonic analysis of compressors is performed with and without splitter vanes. This has generally followed five phases of development, proceeding from a single-bladed cascade to splittered cascades, and finally a fully-rotating compressor. The sections in this report describe the basic method (description of geometry, radial equilibrium, and relaxation portions) and comparison data. GRA

N79-11005# ARO, Inc., Arnold Air Force Station, Tenn.
AERODYNAMIC CHARACTERISTICS OF A 1/24-SCALE F-111 AIRCRAFT WITH VARIOUS EXTERNAL STORES AT MACH NUMBERS FROM 0.5 TO 1.3 Final Report, 23 Dec. 1977 - 9 Jan. 1978
C. F. Anderson AEDC Jul. 1978 132 p
(AD-A057409; AEDC-TR-78-35; AFATL-TR-78-55) HC A07/MF A01 CSCL 20/4

This report presents and discusses the results of transonic wind tunnel tests conducted to evaluate the effects of external stores on the aerodynamic characteristics of the F-111 aircraft at wing sweep angles of 26, 45, and 54 deg. The analysis includes evaluation of the incremental changes in the drag, static margin, and lateral-directional derivatives associated with the various store configurations. Wind tunnel coefficient data for a clean baseline configuration are also presented. Data are presented with pylons alone, GBU-10, GBU-15CCW, GBU-15CCW with extended Pave Tack pod, AGM-65, Rockeye, SUU-30H/B, and MK-82SE stores. Data are presented for Mach numbers ranging from 0.5 to 1.3 at angles of attack from -2 to 16 deg at zero sideslip angle, and for sideslip angles from -10 to 10 deg at angles of attack of 5, 10, and 15 deg. Author (GRA)

N79-11006# European Space Agency, Paris (France).
INVESTIGATIONS OF A HIGHLY LOADED COMPRESSOR CASCADE WITH CONTROL OF THE BLADE BOUNDING LAYER. PART 5: EXPERIMENTAL INVESTIGATIONS OF THE CASCADE WITH SLOTTED BLADES
R. Kiock Sep. 1978 80 p refs Transl. into ENGLISH of 'Untersuch. an einem hochbelasteten Verdichtergitter mit Beeinflussung der Schaufelgrenzschicht. Teil 5: Experimentelle Untersuch. am Gitter mit Spaltschaufeln', DFVLR, Brunswick Report DLR-IB-151-77/14, Oct. 1977 Original report in GERMAN previously announced as N78-31056
(ESA-TT-479; DLR-IB-151-77/14) Avail: NTIS HC A05/MF A01

The working range of a compressor cascade with a high deflection is rather narrow because the steep pressure increases, deriving from even small deviations from the design point, will cause the blade boundary layers to separate. The working range can be widened when secondary air is injected at a point on the suction side; but the mechanical arrangements needed for this involve considerable costs, and a part of the total quantity of air passed through the compressor (2 to 4 %) is lost to permit the injection. It was, therefore, decided to investigate to what extent the working range can be improved when the blades are slotted to permit the passage of air from the pressure side to the suction side. Blades of the same type previously investigated with air injection were therefore slotted in this manner and then subjected to experiment in the form of a plane cascade, the high velocity cascade wind tunnel being used for this purpose. Wake, pressure distribution, and boundary layer measurements were carried out in incompressible flow and also in compressible subsonic flow. Author (ESA)

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N79-11007*# Old Dominion Univ., Norfolk, Va.
AIR CARGO: AN INTEGRATED SYSTEMS VIEW. 1978 SUMMER FACULTY FELLOWSHIP PROGRAM IN ENGINEERING SYSTEMS DESIGN
Alvin Keaton, ed., Robert Eastman, ed., Andrew Hargrove, ed., William Rabiega, ed., Richard Olsen, ed., and Michael Soberick, ed. Hampton, Va. NASA. Langley Res. Center Sep. 1978 339 p refs Sponsored by NASA and the A. Soc. for Eng. Educ.
(NASA-CR-145384) Avail: NTIS HC A15/MF A01 CSCL 01C

The national air cargo system is analyzed and how it should be in 1990 is prescribed in order to operate successfully through 2015; that is through one equipment cycle. Elements of the system which are largely under control of the airlines and the aircraft manufacturers are discussed. The discussion deals with aircraft, networks, facilities, and procedures. The regulations which govern the movement of air freight are considered. The larger public policy interests which must be served by the kind of system proposed, the air cargo integrated system (ACIS), are addressed. The possible social, economical, political, and environment impacts of the system are considered. Recommendations are also given. For individual titles, see N79-11008 through N79-11012.

N79-11008*# Old Dominion Univ., Norfolk, Va.
NETWORK DESIGN
In its Air Cargo: An Integrated Systems View. 1978 Summer Fac. Fellowship Program in Eng. Systems Design Sep. 1978 p 1-102 refs (For primary document see N79-11007 02-03)
Avail: NTIS HC A15/MF A01 CSCL 01C

A transportation network consists of areas to be served, nodal points, and connecting lines between nodos. Node location is treated from theoretical implications derived from a central place theory. The closely associated problems of routing and scheduling are pragmatically treated. Network economics is discussed. Cargo handling capacities and potential at existing airports, by the implications of intermodal transfer upon network design and by the closely allied problems of aircraft payload and fleet-size are also discussed. G.Y.

N79-11009*# Old Dominion Univ., Norfolk, Va.
GROUND SUPPORT
In its Air Cargo: An Integrated Systems View. 1978 Summer Fac. Fellowship Program in Eng. Systems Design Sep. 1978 p 105-156 refs (For primary document see N79-11007 02-03)
Avail: NTIS HC A15/MF A01 CSCL 01E

The ground support system includes the standard business practices used to attract cargo to the air mode, the legal and regulatory framework by which freight is interfaced between surface and air, and the terminal facilities which expedite transfer. These elements of the ground support system are reviewed and it is prescribed how they should appear in the 1990-2015 system. The general design requirements of a cargo terminal, the legal practices needed to support 1990 operations, and the impact of such a system are analyzed. Some operating premises beyond the basic assumptions are used. G.Y.

N79-11010*# Old Dominion Univ., Norfolk, Va.
REGULATIONS AND REGULATORY AGENCIES
In its Air Cargo: An Integrated Systems View. 1978 Summer Fac. Fellowship Program in Eng. Systems Design Sep. 1978 p 159-209 refs (For primary document see N79-11007 02-03)
Avail: NTIS HC A15/MF A01 CSCL 01C

The following topics are discussed: (1) a brief history of aviation regulation and the principle agencies regulating aviation and some of those regulating the carriers with which air carriers must interact; (2) the present economic deregulation, some of its implications for the industry, and prospects for the future; (3) the prospects for intermodal transportation of freight and the various legal and regulatory impediments; and (4) the problems presented to the industry by aircraft noise regulation and some possible approaches to these problems. The intent is to provide both concrete guidance for the near term and an image of the sort of regulatory structure needed to optimize the contribution of air freight to the nation's economy in the 1990's and later. G.Y.

N79-11011*# Old Dominion Univ., Norfolk, Va.
PUBLIC POLICY
In its Air Cargo: An Integrated Systems View. 1978 Summer Fac. Fellowship Program in Eng. Systems Design Sep. 1978 p 213-274 refs (For primary document see N79-11007 02-03)
Avail: NTIS HC A15/MF A01 CSCL 01C

Public policy issues which relate to the air cargo integrated system are basically issues of energy, economics, and politics. The energy picture must be displayed; the economic considerations must be explicated; and the political ambiance in which decisions occur must be defined in order to comprehend the global significance of the ACIS (air cargo integrated system). The following topics are addressed: (1) American political culture as it relates to the ACIS; (2) the economics of materials and energy; (3) the concerns of topic (4) to policy issues; (5) capital formation; (6) military needs and foreign policy; and (7) futures and impacts of the ACIS. G.Y.

N79-11012*# Old Dominion Univ., Norfolk, Va.
IMPACT OF THE ACIS
In its Air Cargo: An Integrated Systems View. 1978 Summer Fac. Fellowship Program in Eng. Systems Design Sep. 1978 p 277-298 refs (For primary document see N79-11007 02-03)
Avail: NTIS HC A15/MF A01 CSCL 01C

It is one thing to use modern technology to develop a system; it is another to ignore the impacts such a system will have on the surrounding physical and cultural environment. The designers of any transportation system must insure that the long term viability of the environment is preserved. Outlines are presented to give understanding to the planning, designing and construction phases of transportation systems as they relate to impacts on the environment (cultural and physical). A summary of the entire text is given for the four topics discussed; network design; ground support; regulation; and public policy. Recommendations are given for the following five areas: (1) aircraft; (2) network structure; (3) ground support; (4) regulation; (5) public policy; and (6) future research and air cargo data development. G.Y.

N79-11013*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
SINGLE PILOT IFR OPERATING PROBLEMS DETERMINED FROM ACCIDENTAL DATA ANALYSIS
Donna L. Forsyth (Florida Univ., Gainsville) and John D. Shaughnessy Sep. 1978 49 p
(NASA-TM-78773) Avail: NTIS HC A03/MF A01 CSCL 05H

The accident reports examined were restricted to instrument rated pilots flying in IFR weather. A brief examination was made of accidents which occurred during all phases of flight and which were due to ail causes. A detailed examination was made of those accidents which involved a single pilot which occurred during the landing phases of flight, and were due to pilot error. Problem areas found include: (1) landing phase operations especially final approach, (2) pilot weather briefings, (3) night approaches in low IFR weather, (4) below minimum approaches, (5) aircraft icing, (6) imprecise navigation, (7) descending below minimum IFR altitudes, (8) fuel mismanagement, (9) pilot overconfidence, and (10) high pilot workload especially in twins. Some suggested areas of research included: (1) low cost deicing systems, (2) standardized navigation displays, (3) low cost low-altitude warning systems, (4) improved fuel management systems, (5) improved ATC communications, (6) more effective pilot training and experience acquisition methods, and (7) better weather data dissemination techniques. L.S.

N79-11014# United Kingdom Bird Impact Research and Development Committee, London (England).
BIRD CONTROL UNITS IN THE ROYAL AIR FORCE Final Report
Jan. 1977 19 p
(Rept-5; BR57281) Avail: NTIS HC A02/MF A01

Results of a trial to control birds at airports and thus reduce the hazard of birdstrike to aircraft is reported. The cost of airfield birdstrikes and bird control units as well as the economics of airfield birdstrike protection are examined. Recommendations as to whether bird control units should be used by the Royal Air Force are made. ESA

N79-11015# European Space Agency, Paris (France).
SOME IMPORTANT RESULTS OBTAINED DURING THE ANALYSIS OF NEAR MISSES AND MIDAIR COLLISIONS
Otto Weber Sep. 1978 49 p refs Transl. into ENGLISH of 'Einige wichtige Erkenntnisse bei der Anal. von kritischen Annaeherungen u. Zusammenstoessen', DFVLR, Brunswick Report DLR-FB-77-25, 14 Jun. 1977 Original report in GERMAN previously announced as N78-31081 Original German report available from DFVLR, Cologne DM 17.70
(ESA-TT-499; DLR-FB-77-25) Avail: NTIS HC A03/MF A01

Theoretical studies on the analysis of near misses and midair collisions under visual meteorological conditions are discussed. The applicability of the rules for collision avoidance for pilots approaching a powered glider or flying in the critical area between collision and overtaking courses, and the effectiveness of horizontal evasive maneuvers in this area are studied using some examples. Restrictions on the visibility of an approaching aircraft due to meteorological optical phenomena, small dimensions, structures in the cockpit, and other tasks of the pilot are discussed for level turning and straight and level flight. The apparent tracks of aircraft in straight flight on the windscreens of aircraft which are performing level turns or straight and level flights are shown, and the limits of visual collision avoidance demonstrated. The results are also applicable to the initial and advanced training of pilots. Author (ESA)

N79-11016# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
LISTING OF ACCIDENTS/INCIDENTS BY AIRCRAFT MAKE AND MODEL, US CIVIL AVIATION, 1976 Accident Report, 1976
13 Apr. 1978 197 p
(PB-283000/8; NTSB-AMM-78-1) Avail: NTIS HC A09/MF A01 CSCL 01B

A listing of all U.S. civil aviation accidents/incidents occurring in calendar year 1976, sorted by aircraft make and model are presented. Included are the file number, aircraft registration number, data and location of the accident, aircraft make and model and injury index for all 4,331 accidents/incidents occurring in the period. GRA

N79-11017# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
BRIEFS OF ACCIDENTS INVOLVING MIDAIR COLLISIONS, US GENERAL AVIATION, 1976 Accident Report, 1976
13 Apr. 1978 59 p
(PB-283001/6; NTSB-AMM-78-2) Avail: NTIS HC A04/MF A01 CSCL 01B

Reports of U.S. general aviation accidents involving midair collisions that occurred in 1976 are presented. Included are 31 accident files, 24 of which involve fatal accidents. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by kind of flying, phase of operation, injury index, altitude of occurrence, airport proximity, aircraft damage, pilot certificate, injuries and causal factor(s). GRA

N79-11018# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
BRIEFS OF ACCIDENTS INVOLVING TURBINE POWERED AIRCRAFT, US GENERAL AVIATION, 1976 Accident Report, 1976
13 Apr. 1978 91 p
(PB-283002/4; NTSB-AMM-78-3) Avail: NTIS HC A05/MF A01 CSCL 01B

Reports of U.S. general aviation turbines powered aircraft accidents occurring in 1976 are presented. Included are 109 accident briefs, 30 of which involve fatal accidents, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damages, pilot certificate, injuries and cause/factor(s). GRA

N79-11019# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
BRIEFS OF ACCIDENTS INVOLVING ROTORCRAFT, US GENERAL AVIATION, 1976 Accident Report, 1976
13 Apr. 1978 101 p
(PB-283003/2; NTSB-AMM-78-4) Avail: NTIS HC A06/MF A01 CSCL 01B

Report of U.S. general aviation rotorcraft accidents occurring in 1976 are presented. Included are 275 accident briefs, 33 of which involve fatal accidents. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information was tabulated by type of accident, phase of operation, injury index, aircraft damage, kind of flying, pilot certificates, injuries, and causes and related factors. GRA

N79-11020# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
BRIEFS OF FATAL ACCIDENTS INVOLVING WEATHER AS A CAUSE/FACTOR, US GENERAL AVIATION, 1976
13 Apr. 1978 281 p
(PB-283004/0; NTSB-AMM-78-5) Avail: NTIS HC A13/MF A01 CSCL 01B

All fatal U.S. general aviation accidents involving weather as a cause/factor for the year 1976 are reported. Two hundred and sixty-two fatal accidents in the brief format are included. This format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Statistical information is tabulated on all accidents involving weather as a cause/factor by type of accident, phase of operation, injury index, aircraft damage, pilots certificate, injuries and cause/factor(s). GRA

N79-11021# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
BRIEFS OF ACCIDENTS INVOLVING ALCOHOL AS A CAUSE/FACTOR, US GENERAL AVIATION, 1976
13 Apr. 1978 46 p
(PB-283005/7; NTSB-AMM-78-6) Avail: NTIS HC A03/MF A01 CSCL 01B

All U.S. general aviation accidents, occurring in 1976, involving alcohol impairment as a cause/factor are reported. Fifty-four accident briefs are included, forty-four of which involve fatal accidents. The brief format presents the facts, conditions, circumstances and probable cause(s)/factor(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and causal factor(s). GRA

N79-11022# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
BRIEFS OF ACCIDENTS INVOLVING MISSING AND MISSING LATER RECOVERED AIRCRAFT, US GENERAL AVIATION, 1976
13 Apr. 1978 94 p
(PB-283006/5; NTSB-AMM-78-7) Avail: NTIS HC A05/MF A01 CSCL 01B

U.S. general aviation missing and missing later recovered accidents occurring in 1976 were reported. Included are 87 accident briefs, 11 of which cover missing aircraft not recovered and 76 missing later recovered. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information is tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and causal factor(s). GRA

N79-11023# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
BRIEFS OF ACCIDENTS INVOLVING CORPORATE/EXECUTIVE AIRCRAFT, US GENERAL AVIATION, 1976
13 Apr. 1978 58 p
(PB-283007/3; NTSB-AMM-78-8) Avail: NTIS HC A04/MF A01 CSCL 01B

U.S. general aviation corporate/executive aircraft accidents occurring in 1976 were reported. Included are 57 accident briefs, 14 of which involve fatal accidents. The brief format presents the facts, conditions, circumstances and probable cause(s) for each accident. Additional statistical information was tabulated by type of accident, phase of operation, injuries and causal/factor(s). GRA

N79-11024# National Transportation Safety Board, Washington, D. C. Bureau of Technology.

BRIEFS OF ACCIDENTS INVOLVING AMATEUR/HOME BUILT AIRCRAFT, US GENERAL AVIATION, 1976
13 Apr. 1978 86 p
(PB-283008/1; NTSB-AMM-78-9) Avail: NTIS HC A05/MF A01 CSCL 01B

U.S. general aviation accidents involving amateur/home built aircraft occurring in 1976 were reported. Included are 135 accident briefs, 39 of which involve fatal accidents. The brief format presents the facts, conditions, circumstances and probable cause(s)/factor(s) for each accident. Additional statistical information was tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries and causal/factor(s). GRA

N79-11025# National Transportation Safety Board, Washington, D. C.
BRIEFS OF ACCIDENTS INVOLVING AERIAL APPLICATION OPERATIONS, US GENERAL AVIATION 1976 Accident Report
13 Apr. 1978 325 p
(PB-283009/9; NTSB-AMM-78-10) Avail: NTIS HC A14/MF A01 CSCL 01B

Reports of U.S. general aviation aerial application accidents occurring in 1976 are presented. Included are 433 accident briefs, 39 of which involve fatal accidents. The brief format presents the facts, conditions, circumstances, and probable cause(s) for each accident. Additional statistical information was tabulated by type of accident, phase of operation, injury index, aircraft damage, pilot certificate, injuries, kind of operation, aircraft accident rates, and causes/factors. GRA

N79-11026# National Transportation Safety Board, Washington, D. C. Bureau of Technology.
BRIEFS OF ACCIDENTS INVOLVING COMMUTER AIR CARRIERS AND ON-DEMAND AIR TAXI OPERATIONS, US GENERAL AVIATION, 1976
13 Apr. 1978 152 p
(PB-283010/7; NTSB-AMM-78-11) Avail: NTIS HC A08/MF A01 CSCL 01B

Commuter air carrier and on-demand air taxi accidents that occurred in 1976 were reported. Included are 33 commuter air carrier and 155 on-demand air taxi accident briefs. The brief format presents the facts, conditions, circumstances and probable cause(s) for each accident. Additional statistical information was tabulated by type of operation, injuries, aircraft weight, cause(s) and related factor(s) and accident rates by the state of occurrence. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N79-11027 Auburn Univ., Ala.
THRESHOLD PROCEDURES FOR TARGET CENTROID ESTIMATION WITH A SCANNING RADAR IN AN AUTOMATED LANDING SYSTEM Ph.D. Thesis
Edward West Smith 1978 89 p
Avail: Univ. Microfilms Order No. 7818634

Two fundamental thresholding procedures are described, which provide target centroid estimates when coupled to a centroid estimator in a scanning radar. The two thresholding techniques were applied to relative voltage returns within target scans produced by a computer-simulated automated landing system. The first technique computed the threshold as a statistic of the stored radar video from each target scan; the threshold was then applied to the data from which it was derived. The second technique involved the prediction of the threshold as a statistic of each successive scan, using a one-step polynomial prediction filter; the threshold was then applied to the incoming radar video from the target scan. Dissert. Abstr.

N79-11028# Rockwell International Corp., Cedar Rapids, Iowa.
THE 3D/4D AREA NAVIGATION SYSTEM DESIGN, DEVELOPMENT AND IMPLEMENTATION. VOLUME 2: SUPPORT DATA AND PROGRAM LISTINGS Final Report
Juergen M. H. Bruckner, F. B. Benson, L. J. McCormick, and T. G. Sharpe Jun. 1977 232 p refs
(Contract DOT-FA72WA-3123)
(AD-A056842; FAA-RD-77-79-Vol-2) Avail: NTIS HC A11/MF A01 CSCL 17/7

The detailed support data for the 4D time control and localizer software definitions are presented. Program listings for the final design are also presented. G.Y.

N79-11029# Federal Aviation Administration, Washington, D. C. Systems Research and Development Service.
THE SELECTION OF ILS LOCALIZER ANTENNA PATTERNS FOR USE IN THE FREQUENCY ASSIGNMENT PROCESS Final Report
Robert D. Smith Sep. 1978 249 p refs
(AD-A057935; FAA-RD-77-130) Avail: NTIS HC A11/MF A01 CSCL 17/7

Measured and theoretical data are compared with FAA antenna pattern specifications. For each antenna type, a single horizontal antenna pattern is recommended for use in the frequency assignment process. Author

N79-11030# Calspan Corp., Buffalo, N. Y.
TIME REFERENCE SCANNING BEAM MULTIMODE DIGITAL PROCESSOR Final Report, 1974 - Apr. 1978
J. Beneke, C. W. Wightman, and C. B. Vallone Apr. 1978 76 p refs
(Contract DOT-FA74WA-3445)
(AD-A058083; AG-5580-E-2; FAA-RD-78-84) Avail: NTIS HC A05/MF A01 CSCL 17/7

Landing system simulations were carried out in support of the microwave landing system (mls) program of the Federal Aviation Administration. Results of extensive simulation evaluations of a multimode digital processor developed for the time reference scanning beam (TRSB) system are presented. Four processing algorithms were developed for the TRSB system. Simulation tests showed that the algorithms developed for the dwell gate processor were less sensitive to multipath errors and had less processing noise than the flight test phase 3 receivers. The split gate processor had smaller multipath and noise errors than the dwell gate processor. Two asymmetrical processing algorithms were implemented that had multipath errors of less than half the magnitude of the dwell gate or split gate techniques. J.M.S.

N79-11031# Lincoln Lab., Mass. Inst. of Tech., Lexington.
FLIGHT RESULTS OF LES-8 AUTONOMOUS STATIONKEEPING SYSTEM
Sushanta Srivastava 25 Apr. 1978 36 p refs
(Contract F19628-78-C-0002)
(AD-A056152; TN-1978-8; ESD-TR-78-74) Avail: NTIS HC A03/MF A01 CSCL 22/3

This note is a summary of the initial flight results of the Lincoln Experimental Satellite 8 (LES-8) autonomous stationkeeping system. The autonomous stationkeeping system on LES-8 was activated between 7 July and 4 October 1976 for stationkeeping the satellite at 109.7 deg W longitude. The satellite acquired station without overshoot and maintained the station with an absolute accuracy of 0.06 deg. The fuel efficiency during this experiment in the overdamped mode was about 50%. Author (GRA)

N79-11032# Army Aviation Research and Development Command, St. Louis, Mo.
AN ANTI-JAM MANPACK ANTENNA FOR GLOBAL POSITIONING SYSTEM APPLICATION
Jack Gray and Charles M. DeSantis May 1978 45 p
(AD-A057265; USAAVRADCOM-TR-78-11) Avail: NTIS HC A03/MF A01 CSCL 17/4

The GPS Anti-Jam Manpack Antenna (AJMA) system is an ECCM addition to the GPS manpack/vehicular user equipment

which will minimize GPS receiver performance degradation due to a jammer by steering a null into the direction of the interference source. Operating strictly at the GPS RF signal level AJMA will easily interface with a GPS receiver without modification and add minimal signal degradation. From results of the experiments described, it is concluded that there exists a feasible method of using null-steering antenna systems to counter CW jammer threats. A number of AJMA configurations were applied successfully and tested practically. Author (GRA)

N79-11033# European Space Agency, Paris (France).
BETTER PERFORMANCE FOR AIRCRAFT TRACKING AND HOLDING UNDER GUST AND SHEARWIND INFLUENCE BY USE OF DIRECT DIGITAL CONTROL
Hans Gerd Schlueter and Klaus Bender Sep. 1978 54 p refs Transl. into ENGLISH of 'Ein Beitr. zur Erhoehung der Bahnfuehrungsgenauigkeit von Flugzeugen gegenueber Windstoerungen mit Hilfe einer direkten digitalen Steuerung', DFVLR, Brunswick Report DLR-FB-77-48, 14 Nov. 1977 Original report in GERMAN previously announced as ESA-91009 Original German report available from DFVLR, Cologne DM 20.70
(ESA-TT-506; DLR-FB-77-48) Avail: NTIS HC A04/MF A01

The application of direct digital control for aircraft control is proposed. Using this technique, no aerodynamic states are considered for the invariance conditions against wind and gust disturbances. Thus, high accuracy for path holding and tracking can be achieved. A simple iteration-procedure calculates the control input necessary to compensate the influence of wind on the commanded aircraft acceleration. The inverse solutions of the nonlinear and coupled equations of forces and moments were determined online by use of an airborne digital computer. Sensitivity to parameter changes is reduced by use of additional feedback and adaptation loops. Author (ESA)

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N79-11034*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AN OVERVIEW OF THE QUIET SHORT-HAUL RESEARCH AIRCRAFT PROGRAM
Michael D. Shovlin and John A. Cochrane Nov. 1978 41 p refs
(NASA-TM-78545; A-7672) Avail: NTIS HC A03/MF A01 CSCL 01C

An overview of the Quiet Short Haul Research Aircraft (QSRA) Program is presented, with special emphasis on its propulsion and acoustic aspects. A description of the NASA technical participation in the program including wind tunnel testing, engine ground tests, and advanced aircraft simulation is given. The aircraft and its systems are described and, measured performance, where available, is compared to program goals. Preliminary data indicate that additional research and development are needed in some areas of which acoustics is an example. Some of these additional research areas and potential experiments using the QSRA to develop the technology are discussed. The concept of the QSRA as a national flight research facility is explained. B.B.

N79-11035# Naval War Coll., Newport, R. I. Center for Advanced Research.
FEASIBILITY OF TACTICAL USMC VSTOL AIRCRAFT OPERATING ABOARD MERCHANT SHIPS 1990-2000
James W. Orr Jun. 1978 112 p refs
(AD-A056267) Avail: NTIS HC A06/MF A01 CSCL 13/10

Two trends indicate a potential problem in the movement of tactical aircraft, specifically Maine Corps tactical aircraft, to combat areas in a large portion of the world. Reduced numbers of U.S. Navy ships and constrained basing and overflight right may limit access to those combat areas which can be reached by air-refueled ferry flights from U.S. bases. Relatively simple modifications to some newer ships in the U.S. merchant fleet will permit flight operations by present and proposed inventories of USMC vertical and short takeoff and landing (VSTOL) aircraft. Shipboard requirements are identified and potential ship installations are suggested. Emphasis is placed on integration of existing or already proposed hardware to increase the tactical air firepower which may be brought to bear in remote geographic areas of national interest. Author (GRA)

N79-11036# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
INVESTIGATION OF THE YF-16 IN HIGH ANGLE OF ATTACK ASYMMETRIC FLIGHT M.S. Thesis
Eric B. House, II Mar. 1978 165 p refs
(AD-A056511; AFIT/GAE/AA/78M-6) Avail: NTIS HC A08/MF A01 CSCL 01/3

A study was made of the theoretical departure modes of the YF-16 due to pitch and yaw perturbations from asymmetrical rectilinear flight. An alpha-beta control boundary was developed, and within that boundary perturbations of 20 deg/sec and 30 deg/sec were introduced. The areas of uncontrolled motions were mapped out and the motions were categorized. Three types of motions were identified: erect spins, inverted spins, and rolling departures. For yaw perturbations only, a simple controller was modelled which had as its inputs alpha, beta, and yaw rate. The controller prevented the aircraft from departing controlled flight. Time traces of the various departure modes and the effects of including a departure controller are presented in the appendices. Author (GRA)

N79-11037# Army Aviation Research and Development Command, St. Louis, Mo.
COMPARISON OF THE EFFECT OF STRUCTURAL COUPLING PARAMETERS ON FLAP-LAG FORCED RESPONSE AND STABILITY OF A HELICOPTER ROTOR BLADE IN FORWARD FLIGHT
Daniel P. Schrage and David A. Peters Jun. 1978 15 p refs
(AD-A056485) Avail: NTIS HC A02/MF A01 CSCL 01/1

An eigenvalue and modal decoupling method to predict helicopter rotor stability and forced response has been successfully developed. The advantages of this method are: Stability and forced response are obtained from the same method, thus allowing direct comparison of parametric effects; Only one rotor revolution of numerical integration for an initial condition of unity imposed on each degree of freedom is necessary to define the Floquet Transition Matrix, therefore, the ambiguous interpretation of time history response data over many rotor revolutions and the separation of transient and forced response is no longer necessary; and Additional degrees of freedom such as hub and airframe motions, inflow feedback, etc. in both the fixed and rotating systems can be included since Floquet theory is applicable to equations with periodic coefficients. GRA

N79-11038# Bell Helicopter Co., Fort Worth, Tex.
VIBRATORY ICE PROTECTION FOR HELICOPTER ROTOR BLADES Final Report
H. E. Lemont and H. Upton Jun. 1978 170 p refs
(Contract DAAJ02-76-C-0051; DA Proj. 1F2-62209-A-H76)
(AD-A057329; USAAMRDL-TR-77-29) Avail: NTIS HC A08/MF A01 CSCL 01/3

This report presents the results of a study on vibrational deicing of main and tail rotor blades through higher harmonic shaking of the blades with aerodynamic, mechanical, and hydraulic shakers. Studies were made of various locations for mounting shakers, the forces and frequencies to deice, types of shakers, concept effectiveness, energy requirements, system reliability, system maintainability, weights, costs, aircraft performance penalties, impact on countermeasure methods, effects on aircraft components, and applicability to main and tail rotor blades of both metal and composite construction. Ratings of systems to vibrate blades are compared; electrical control diagrams for shaker mechanisms are presented; and results of a breadboard test are included. A bibliography is presented of reports pertinent to vibrational deicing of rotor blades. Author (GRA)

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

N79-11039*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

DESCRIPTION AND PRELIMINARY STUDIES OF A COMPUTER DRAWN INSTRUMENT LANDING APPROACH DISPLAY

James J. Adams and Frederick J. Lallman Nov. 1978 44 p refs

(NASA-TM-78771; L-12269) Avail: NTIS HC A03/MF A01 CSCL 01D

A computer drawn instrument landing approach display, which shows a box located on the desired path, aligned with the path, and moving along the path at a selected distance ahead of the aircraft, was examined. Vertical and lateral displacements from the desired path and aircraft altitude information are used as inputs to the computer. A preliminary simulation study with pilot subjects has shown that the pilots find the display very easy to use, and they achieved better performance scores with the box display than with a cross pointer instrument landing display. Author

N79-11040# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.

THE IMPACT OF WIDEBAND MULTIPLEX CONCEPTS ON MICROPROCESSOR-BASED AVIONIC SYSTEM ARCHITECTURES Final Report, Jun. 1976 - Dec. 1977

E. Douglas Jensen, George D. Marshall, Wallace F. Helmbrecht, and James A. White Feb. 1978 292 p refs

(Contract F33615-76-C-1285; AF Proj. 2003)

(AD-A057878; HONEYWELL-77SRC90; AFAL-TR-78-4) Avail: NTIS HC A13/MF A01 CSCL 09/3

This report explores the implications of fiber optic interconnections and intelligent (i.e., microprocessor-based) communication interface units on the architecture of distributed processing systems for future avionics applications. The study consisted of eight technical tasks: Task 1: Survey the F-15, F-16, F-18, B-1, Space Shuttle Orbiter, and AMST Data Multiplex Subsystems; Task 2: Identify Bus Bandwidth-Related Tradeoffs in DAIS, DP/M, GPMS, and HXDP Architectures; Task 3: List Typical Avionic Multiplex Subsystem Requirements; Task 4: Define Requirements Benchmark Scenario; Task 5: Design Candidate Avionic Multiplex Subsystem Architectures; Task 6: Evaluate Candidate Avionic Multiplex Subsystem Architectures; Task 7: Compare Selected Multiplex Subsystem with DAIS, DP/M, GPMS, and HXDP; and Task 8: Project Impact of Higher Interconnection Bandwidth and Intelligent Communication Interfaces on Future Avionic System Designs. GRA

N79-11041# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.

INVESTIGATION ON FUNDAMENTALS, SYSTEMS LAYOUT AND APPLICABILITY OF INFRARED VISUAL SYSTEMS FOR CIVIL AVIATION [UNTERSUCHUNG UEBER GRUNDLAGEN, SYSTEMAUSLEGUNG UND ANWENDBARKEIT VON INFRAROT-SICHTSYSTEMEN FUER DIE ZIVILE LUFTFAHRT]

Olaf Peters and Klaus Dytrt 1977 84 p refs In GERMAN

(ILR-25; ISBN-3-7983-0611-7) Avail: NTIS HC A05/MF A01

The possibility of replacing conventional visual equipment (TV systems) with infrared visual detectors was explored. The influence of absorption and scattering on IR radiation is discussed. The applicability of IR detectors in IR visual systems was studied. Scanning, image analyzing, signal processing, and image synthesis are discussed. Flight control and safety technology aspects are dealt with. The possibility of integrating IR visual system in existing radio location and TV systems is discussed. Estimations on system performance, reliability, and costs of such systems are presented. ESA

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N79-11042*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

DEFINITION STUDY OF A VARIABLE CYCLE EXPERIMENTAL ENGINE (VCEE) AND ASSOCIATED TEST PROGRAM AND TEST PLAN Final Report, Sep. 1977 - Mar. 1978

R. D. Allan Oct. 1978 198 p

(Contract NAS3-20810)

(NASA-CR-159419; R78AEG568) Avail: NTIS HC A09/MF A01 CSCL 21E

The Definition Study of a Variable Cycle Experimental Engine (VCEE) and Associated Test Program and Test Plan, was initiated to identify the most cost effective program for a follow-on to the AST Test Bed Program. The VCEE Study defined various subscale VCE's based on different available core engine components, and a full scale VCEE utilizing current technology. The cycles were selected, preliminary design accomplished and program plans and engineering costs developed for several program options. In addition to the VCEE program plans and options, a limited effort was applied to identifying programs that could logically be accomplished on the AST Test Bed Program VCE to extend the usefulness of this test hardware. Component programs were provided that could be accomplished prior to the start of a VCEE program. Author

N79-11043*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INFRARED SUPPRESSOR EFFECT ON T63 TURBOSHAFT ENGINE PERFORMANCE

Everett E. Bailey, Kestutis C. Civinskas, and Curtis L. Walker Sep. 1978 14 p ref

(NASA-TM-78970; E-9730; AVRADCOM-TR-78-38(PL)) Avail: NTIS HC A02/MF A01 CSCL 21E

Tests were conducted to determine if there are performance penalties associated with the installation of infrared (IR) suppressors on the T63-A-700 turboshaft engine. The testing was done in a sea-level, static test cell. The same engine (A-E402808 B) was run with the standard OH-58 aircraft exhaust stacks and with the ejector-type IR suppressors in order to make a valid comparison. Repeatability of the test results for the two configurations was verified by rerunning the conditions over a period of days. Test results showed no measurable difference in performance between the standard exhaust stacks and the IR suppressors. Author

N79-11044# Telephonics, Huntington, N.Y.

DEVELOPMENT OF TRANSISTORIZED SOLID STATE POWER CONTROLLERS FOR B-1 FLIGHT TESTS Final Report, Jan. 1974 - Jun. 1977

G. Altemose Nov. 1977 70 p refs

(Contract F33615-74-C-2031)

(AD-A056256; AFAPL-TR-77-67) Avail: NTIS HC A04/MF A01 CSCL 09/3

Fifty-nine transistorized solid state power controllers have been developed, fabricated and tested. These devices are rated at 1.6 A/230V/400Hz, possess the control/protect functions, are hermetically sealed, and are packaged in a flight worthy configuration. Details of the design, assembly, and testing are included in this report. Author (GRA)

N79-11045# Naval Postgraduate School, Monterey, Calif.

A VALIDATION OF MATHEMATICAL MODELS FOR TURBOJET TEST CELLS M.S. Thesis

John Justin Walters Mar. 1978 69 p refs

(AD-A056333) Avail: NTIS HC A04/MF A01 CSCL 21/5

Previously developed one-dimensional and two-dimensional computer models for predicting turbojet test cell performance were compared with data obtained from a subscale test cell for

the purpose of model validation. Comparisons were made for a variety of configurations and flow rates. A modified one-dimensional model was found to reasonably predict the variation of augmentation ratio with engine flow rate, although predicted magnitudes were consistently too small. The model incorporated excessive drag losses and an inaccurate jet spreading parameter for large engine-augmentor spacings. The two-dimensional model accurately predicted experimental velocity profiles, but over-predicted pressure variations, except for low engine exit Mach numbers. Author (GRA)

N79-11046# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
PERFORMANCE EVALUATION OF A SMALL TURBO-CHARGER ENGINE M.S. Thesis
Michael OBrien Mar. 1978 55 p refs
(AD-A056246; AFIT/GAE/AA/78M-13) Avail: NTIS HC A04/MF A01 CSCL 21/5

Performance data were taken for a small turbojet engine which is made up of a turbo supercharger and a catalytic combustor, which were originally intended for automotive use. The design employed the catalyst to promote a hydrogen reaction in air to power the rotating machinery. Several turbine housings each used with various nozzles were run on the engine to produce performance data. Using a turbine inlet temperature limit of 1800F and a rotating speed limit of 120,000 RPM, a maximum thrust of 34 lb. was recorded. Stable engine operation was observed in most configurations. Performance compared well with theoretical data supplied by the CARPET computer program. Author (GRA)

N79-11047# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ELECTRONIC ANALYSIS OF ELECTROSTATIC PULSE TO DETECT IMMINENT JET ENGINE GAS-PATH FAILURE M.S. Thesis
Freddy Leon Baker Dec. 1977 84 p refs
(AD-A056515; AFIT/GE/EE/77-7) Avail: NTIS HC A05/MF A01 CSCL 21/5

A jet engine gas-path wear rate monitor has been designed and tested. The monitor observes gas-path component rubbing, chaffing, burning, or erosion by measuring the electrostatic charge in the engine exhaust. This system continuously monitors the exhaust during engine operation, and periodically checks the total metal content in the exhaust to determine the deterioration rate of gas-path components. The design of the monitor is based on 4000 hours of early TF41 electrostatic count data and on 2000 hours of recent analog tape recorded data produced by TF41 engines undergoing severe distresses. This thesis describes the theory and operation of the wear rate monitor. First, the design and installation of the optimized probes is presented. Next, the theory and operation of the analog and digital circuits in the wear rate monitor is discussed. Circuit diagrams are given for all of the electronic components of the monitor. Then, the techniques for adapting the monitor to engines other than the TF41 turbofan engine are presented. GRA

N79-11048# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AN EXPERIMENTAL STUDY OF A CATALYTIC COMBUSTOR FOR AN EXPENDABLE TURBOJET ENGINE M.S. Thesis
Larry E. Taylor Mar. 1978 43 p refs
(AD-A056512; AFIT/GAE/AA/78M-15) Avail: NTIS HC A03/MF A01 CSCL 21/5

A catalytic combustor was designed, an existing one modified, and both were tested on a small turbojet engine. The existing catalytic combustor, combustor A, used straight through flow and was modified by adding a flame arrestor to the combustor inlet. Combustor B was designed to use reverse flow with a preburner and air dilution zones. Combustors A and B were designed for an air capacity up to 0.75 lbm/sec and outlet temperatures of 1800 F. Combustor B did prove successful. Cold flow total pressure loss in combustor B was two percent, while the total pressure loss during heat addition was a maximum of seven percent. The flame arrestors tested on combustor A did not prove to be successful. Hydrogen was used as fuel for both combustors. Temperatures across the catalyst face varied by 290 F at a turbine inlet temperature of 1070 F, 370 F at 1450 F. Turbine inlet temperatures varied by 55 F at an average 1045 F, 190 F at an average 1475 F. The maximum temperature rise across the combustor during testing was 1565 F and the maximum turbine inlet temperature tested was 1855 F.GRA

N79-11049# Delta Electronic Control Corp., Irvine, Calif.
DEVELOPMENT OF A 10 KVA POWER CONDITIONER UNIT, AIRCRAFT, 115/200 VOLT, 3-PHASE, 400 Hz Final Report
W. G. Lawrence Apr. 1978 38 p
(Contract N62269-76-C-0076)
(AD-A056119; DECC-61126-001) Avail: NTIS HC A03/MF A01 CSCL 10/2

This paper discusses the development of parallelable power conditioning units capable of operating from 200 V line-to-line, 3 phase 400 Hz ac or 270 V dc input power to produce a 10 kVA regulated, low-distortion 115/200 Vac, 3 phase, 400 Hz output. Author (GRA)

N79-11050# Naval Test Pilot School, Patuxent River, Md.
PRINCIPLES OF JET ENGINE OPERATION
John A. Morrison May 1978 148 p Revised
(AD-A056158; USNTPS-T-3) Avail: NTIS HC A07/MF A01 CSCL 21/5

This manual is primarily a guide for pilots, Naval Flight officers, and engineers attending the U.S. Naval Test Pilot School. The purpose of this manual is to present the concepts underlying the gas turbine engine, to develop the component characteristics, and to combine the components into an 'operating' engine. The configurations considered are the turbojet, the by-pass and the turbo-prop engines. Author (GRA)

N79-11051# Flight Dynamics Research Corp., Van Nuys, Calif.
END WALL AND CORNER FLOW IMPROVEMENTS OF THE RECTANGULAR ALPERIN JET-DIFFUSER EJECTOR Final Report, May 1977 - May 1978
Morton Alperin and Tiunn-Jenq Wu May 1978 77 p refs
(Contract N62269-77-C-0232)
(AD-A057663; NADC-77050-30) Avail: NTIS HC A05/MF A01 CSCL 21/5

A generalized ring vortex system was utilized to determine the pressure distributions and streamline shapes within a three-dimensional jet-diffuser ejector. Experiments verified the utility of the method and resulted in a measured performance exceeding that of the original STAMP (Small Tactical Aerial Mobility Platform) Ejector, while avoiding the use of the large, protruding end plates required by that ejector. Ground effect tests on the new design showed improved performance compared to similar tests on the STAMP Ejector over the entire range of ground clearances. Author (GRA)

N79-11052# ARO, Inc., Arnold Air Force Station, Tenn.
EXHAUST PLUME THERMODYNAMIC EFFECTS ON NONAXISYMMETRIC NOZZLE AFTERBODY PERFORMANCE IN TRANSONIC FLOW Final Report, 24 Nov. - 4 Dec. 1976
C. E. Robinson AEDC Aug. 1978 98 p refs
(AD-A057363; AEDC-TR-78-24) Avail: NTIS HC A05/MF A01 CSCL 20/4

An experimental investigation was conducted to determine the effect of exhaust plume thermodynamic properties on a nonaxisymmetric nozzle afterbody. The model consisted of a strut-mounted cone-cylinder with an isolated nozzle afterbody. The shape of the nozzle afterbody was generally based on the early configurations of the ADEN design. An ethylene/air combustor was used to vary the thermodynamic properties by varying fuel-to-air ratio. Data were obtained at four fuel-to-air ratios representing exhaust plume temperatures of approximately 500 F (cold flow, fuel-to-air = 0), 1,200, 1,500, and 1,900 R. Pressure measurements of the nozzle afterbody surface were obtained from which drag coefficients along the rows of pressure orifices were calculated. The investigation was conducted over a range of Mach numbers from 0.6 to 1.4 at a Reynolds number per foot of 2.5 million. Generally, the nozzle afterbody drag decreased with increasing exhaust plume temperature over the entire Mach number range. GRA

N79-11053# General Electric Co., Schenectady, N. Y.
SILICON NITRIDE FOR AIRBORNE TURBINE APPLICATIONS Final Technical Report, 11 Apr. 1977 - 11 Apr. 1978
John A. Palm and Charles D. Greskovich Jul. 1978 52 p refs
(Contract N00019-77-C-0259)
(AD-A057338; SRD-78-076) Avail: NTIS HC A04/MF A01 CSCL 11/2

Procedures are described for processing a commercially available alpha-Si3N4 power which allow it to be hot-pressed to theoretical density when small additions of BeSiN2 are added to the processed powder. Studies of the macro- and microstructural character of the hot pressed ceramic were conducted. The results of that study emphasized the need for thorough and homogeneous blending of the Si3N4 powder prepared and made ready for hot pressing. Investigations were conducted on the thermomechanical behavior of the fully dense hot pressed Si3N4 and measurements made at temperatures up to 1500 C of important thermomechanical properties. These properties included creep resistance, strength, dynamic fatigue and oxidation resistance. Comparison of these data were made with properties determined for NC-132, a commercial hot pressed Si3N4 ceramic.
Author (GRA)

N79-11054# Naval Ship Research and Development Center, Bethesda, Md. Dept. of Aviation and Surface Effects.
AN INVESTIGATION OF THE PERFORMANCE OF A J52-P-8A ENGINE OPERATING UNDER THE INFLUENCE OF HIGH BLEED FLOW EXTRACTION RATES
Rodney A. Hemmerly Aug. 1977 99 p refs
(ZF41400001)
(AD-A057325; DTNSRDC/ASED-387) Avail: NTIS HC A05/MF A01 CSCL 21/5

The uninstalled performance characteristics of a J52-P-8A engine operating under the influence of bleed flow extraction rates in excess of the standard specification limits were experimentally evaluated. This investigation was undertaken as part of the Circulation Control Wing Flight Demonstrator Program to assess engine capability of supplying airflow to power the high-lift aerodynamic system incorporated on the Flight Demonstrator and define a data base from which higher confidence level analytical short takeoff and landing performance evaluations could be obtained. Results of the investigation indicate that bleed flow extraction rates significantly greater than the standard specification limits are obtainable. An endurance evaluation of the engine operating under the influence of the high bleed flow extraction rates indicates that these extraction rates do not adversely affect the J52-P-8A engine. The results of the endurance evaluation should serve to qualify the J52-P-8A engine for the proposed Flight Test Program. Author (GRA)

N79-11055# General Electric Co., Cincinnati, Ohio. Material and Process Technology Labs.
SUPERALLOY KNIFE EDGE SEAL REPAIR Final Report, 1 Mar. 1976 - 31 Nov. 1977
R. E. Kutchera and P. G. Bailey May 1978 116 p refs
(Contract F33615-76-C-5123; AF Proj. 7351)
(AD-A057269; AFML-TR-78-56) Avail: NTIS HC A06/MF A01 CSCL 11/6

A twenty month effort has successfully demonstrated the feasibility of the Continuous Seam Diffusion Bonding (CSDB) process for repairing knife edge seal teeth on superalloy engine components. Seal teeth rings from the F101, Rene 95, Compressor Rotor Spool (CRS), stages 4-9, containing five representative seal teeth clusters were used for this investigation. The Rene 95 seal teeth were repaired with Inconel 718 tip extension material. The developed processes were utilized to repair two seal teeth rings machined from the CRS. Isothermal rolling was used successfully to initially widen the seal teeth bond interface to facilitate notch-free diffusion bonds after reprofiling. CSDB parameters were established for bonding the Inconel 718 to the Rene 95 seal teeth. A closure technique was developed to complete the circumferential bonding of a seal teeth ring. GRA

N79-11056# Advisory Group for Aerospace Research and Development, Paris (France).
SEAL TECHNOLOGY IN GAS TURBINE ENGINES
Aug. 1978 277 p refs Presented at the Propulsion and Energetics Panel's 51st (B) Specialists' Meeting, London, 6-7 April 1978
(AGARD-CP-237; ISBN-92-835-0218-3) Avail: NTIS HC A13/MF A01

Both gas and oil path seals are discussed as well as developments in material technology that influences seal design and operation. The impact of turbine engine operation on seal performance is examined as well as the effect of seal performance on engine maintenance. Laboratory measurements and test facilities for investigating seal behavior are described as well as design methods. For individual titles, see N79-11057 through N79-11073.

N79-11057*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GAS PATH SEALING IN TURBINE ENGINES
Lawrence P. Ludwig *In* AGARD Seal Technol. in Gas Turbine Eng. Aug. 1978 41 p refs (For primary document see N79-11056 02-07)
Avail: NTIS HC A13/MF A01 CSCL 21E

Gas path seals are discussed with emphasis on sealing clearance effects on engine component efficiency, compressor pressure ratio, and stall margin. Various case-rotor relative displacements, which affect gas path seal clearances, are identified. Forces produced by nonuniform sealing clearances and their effect on rotor stability are examined qualitatively, and recent work on turbine-blade-tip sealing for high temperatures is described. The need for active clearance control and for engine structural analysis is discussed. The functions of the internal-flow system and its seals are reviewed. A.R.H.

N79-11058# Rolls-Royce Ltd., Bristol (England). Mechanical Research Dept.
USE OF COATINGS IN TURBOMACHINERY GAS PATH SEALS
J. G. Ferguson *In* AGARD Seal Technol. in Gas Turbine Eng. Aug. 1978 15 p (For primary document see N79-11056 02-07)
Avail: NTIS HC A13/MF A01

Abradable coatings, found in many seals throughout a gas turbine engine from the fan to the turbine, have to cope with a temperature range from a little above ambient to 1 250 K. Test methods exist for laboratory and rig evaluation of coatings, and these are discussed, but improved methods for evaluation of erosion and abradability are required. To overcome shortcomings in current abradable coating materials, many are at present being tailored specially to meet the conditions in particular seals within an engine. This means that there are several different coatings, within any given engine, each having a limited range of use. New coatings are still required which can be used in a wide range of applications throughout an engine. There is, in particular, an urgent need for abradable materials which can be used in turbine seals covering a temperature range from 870 K to 1 250 K. A.R.H.

N79-11059# Solar Turbines International, San Diego, Calif. Materials Engineering Dept.
ABRASIVE COATINGS AS SELF CLEANING GAS TURBINE COMPRESSOR VANE TIP SEALS
A. R. Stetson, J. W. Vogan, and W. A. Compton *In* AGARD Seal Technol. in Gas Turbine Eng. Aug. 1978 16 p (For primary document see N79-11056 02-07)
Avail: NTIS HC A13/MF A01

Efficiency of a gas turbine is reduced by vane tip losses in the compressor section. Vane tip/rotor rubs can result in catastrophic failure of a gas turbine engine. A test rig is described as well as experimental data obtained evaluating abrasive coatings for clearance control between the vanes and the rotor in a gas turbine compressor. Plasma/flame sprayed oxides, carbides and chemically bonded abrasives were tested under conditions duplicating those encountered in the compressor section. The effectiveness of the coatings in grinding away the vane tips to provide minimum clearance without damage to the vane or rotor was determined. Coatings with rough, sharp abrasive grains were most effective. The laboratory tests were confirmed by engine development tests with a full-scale rotor. A.R.H.

N79-11060# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
APPLICATION OF THE OHP METALLIC FELTS TO TURBOMACHINE SEALS
Emile Genieys (Societe Heurchrome, France) and Andre Hivert *In* AGARD Seal Technol. in Gas Turbine Eng. Aug. 1978 7 p refs In FRENCH (For primary document see N79-11056 02-07)
Avail: NTIS HC A13/MF A01

Metallic felts characterized by a very high porosity (up to 95%) and a fine structure (10 to 30 micron-dia-tubular fibers), were fabricated by the electrodeposition of a metal, such as nickel, on carbon fibers made by pyrolysis of cellulose. Loose fibers were transformed into felts by means of paper works techniques of sedimentation by gravity or centrifugation. A sintering operation consolidates the material and eliminates the carbon. The extreme plasticity of these felts and their aptitude to receive by gaseous diffusion chromium or aluminum make them particularly suitable for turbomachine seals. Metallo-ceramic sealing techniques for the low and medium temperatures (up to 500 C) and brazing processes for higher temperatures were developed. The seals are operational up to 800 C, they are at the bench testing stage for higher temperatures, up to 1050 C. A.R.H.

N79-11061# American Airlines, Inc., Tulsa, Okla.
AMERICAN AIRLINES' OPERATIONAL AND MAINTENANCE EXPERIENCE WITH AERODYNAMIC SEALS AND OIL SEALS IN TURBOFAN ENGINES
C. R. Smith *In* AGARD Seal Technol. in Gas Turbine Eng. Aug. 1978 11 p (For primary document see N79-11056 02-07)
Avail: NTIS HC A13/MF A01

User experience with aerodynamic and oil system seal designs currently used in commercial turbofan engines is reported with emphasis on operational performance, seal reliability, seal repair techniques, and seal maintainability costs. Gas path deterioration resulting from sealing problems and the effects of associated hardware problems on seal performance are examined. The impact of this deterioration on fuel consumption, maintenance requirements (engine management), and airline operations and operating costs is discussed. A.R.H.

N79-11062# Rolls-Royce Ltd., Derby (England). Technical Design Group.
OIL SEALING OF AERO ENGINE BEARING COMPARTMENTS
D. C. Whitlock *In* AGARD Seal Technol. in Gas Turbine Eng. Aug. 1978 11 p (For primary document see N79-11056 02-07)
Avail: NTIS HC A13/MF A01

The basic problem of oil sealing of aero engine bearing compartments is to provide a seal between rotating and static components, or between rotating components, accommodating axial movements and possible radial excursions (such a shaft whirling). The sealing arrangements must also conform to modular concepts of engine construction. Such seals incur penalties on the oil system such as heat generation, air leakage and debris generation. Means of reducing these penalties and improving sealing integrity by developments of existing techniques are considered. A.R.H.

N79-11063# Ecole Polytechnique Federale de Lausanne (Switzerland). Institut de Thermique Appliquee.
TRANSPORT PHENOMENA IN LABYRINTH-SEALS OF TURBOMACHINES
Tahsin Boyman and Peter Suter *In* AGARD Seal Technol. in Gas Turbine Eng. Aug. 1978 10 p refs (For primary document see N79-11056 02-07)
Avail: NTIS HC A13/MF A01

The oil-fog and the oil-vapor produced in the region of bearings may be transported through the labyrinth glands in the direction opposite to the buffering-fluid-flow. This undesired transport results from the diffusion of the oil-vapor due to the concentration gradient, and the transport of small oil droplets due to the complex flow created in the labyrinth seals. The intensity and limits of these two phenomena are studied theoretically as well as experimentally, using a real size model and in a second large scale model, both of the straight-through-type with moving fins and a stationary outer cylinder. A.R.H.

N79-11064# Stuttgart Univ. (West Germany). Institut fuer Thermische Stromungsmaschinen.
STUDIES ON VIBRATIONS STIMULATED BY LATERAL FORCES IN SEALING GAPS
H. Benckert and J. Wachter *In* AGARD Seal Technol. in Gas Turbine Eng. Aug. 1978 11 p refs (For primary document see N79-11056 02-07)
Avail: NTIS HC A13/MF A01

Vibrational problems in high power density turbomachines arise from exciting forces in sealing gaps which result in unsymmetrical pressure distribution within the sealing. A test facility is described for studying the flow in sealing gaps in a variety of labyrinth configurations. The following parameters can be varied: the shaft rotation, the pressure difference on the seal, the entry-swirl, the eccentricity of the rotor and the geometry of the labyrinth. Test results indicate systematic dependence of the excited lateral forces on these parameters. For a given labyrinth the corresponding force coefficient is resulted to the energy conditions of the flow and the pressure difference on the seal. Two examples of calculation demonstrate the application of the test results. A.R.H.

N79-11065# Rolls-Royce Ltd., Bristol (England). Advanced Projects Dept.
THE CONTRIBUTION OF DYNAMIC X-RAY TO GAS TURBINE AIR SEALED TECHNOLOGY
P. A. E. Stewart and K. A. Brasnett *In* AGARD Seal Technol. in Gas Turbine Eng. Aug. 1978 13 p refs (For primary document see N79-11056 02-07)
Avail: NTIS HC A13/MF A01

A radiographic technique is described for studying the behavior of components (particularly seals) during the full range of gas turbine operation. Its application to a wide range of engines, particularly during transient conditions is discussed. A.R.H.

N79-11066# Politecnico di Milano (Italy). Instituto di Macchine.
EXPERIMENTAL RESULTS ON HIGH SPEED DOUBLE MECHANICAL SEALS
Enrico Bollina, Corrado Casci, and Ennio Macchi *In* AGARD Seal Technol. in Gas Turbine Eng. Aug. 1978 10 p refs (For primary document see N79-11056 02-07)
Avail: NTIS HC A13/MF A01

A facility for testing high speed mechanical seals is described. Its main features are: (1) the possibility of continuously varying the rotating speed up to 60,000 rpm; (2) the possibility of independently selecting the flow rate, the pressure and the nature of the sealing and cooling fluid; (3) the seal power consumption is accurately measured by means of a force transducer. The performance of a number of double face mechanical seals having different geometries was investigated. Results concerning the mechanical losses and the leakage flow rates of these seals under various operating conditions are presented and discussed. Author

N79-11067# Rolls-Royce Ltd., Derby (England). Electronics and Instrumentation Research Dept.
SYSTEMS FOR THE MEASUREMENT OF ROTOR TIP CLEARANCE AND DISPLACEMENT IN A GAS TURBINE
C. R. Amsbury and J. W. H. Chivers *In* AGARD Seal Technol. in Gas Turbine Eng. Aug. 1978 11 p refs (For primary document see N79-11056 02-07)
Avail: NTIS HC A13/MF A01

The rotor tip clearance system was developed which consists basically of a stepper motor driven insulated wire which is polarized at a high voltage and which sparks to the rotor blade tips when within a certain distance. The incidence of sparking is detected and the radial immersion of the wire is determined by electronically counting the motor drive pulses. The displacement system is based upon a capacitance transducer specifically designed for operation within a gas turbine at temperatures of up to 600 C and pressures of 300 psi. The transducer capacitance which is a function of probe/rotating seal clearance is connected into the feedback loop of an amplifier, the output of which is proportional to the clearance. A.R.H.

N79-11068*# Detroit Diesel Allison, Indianapolis, Ind. Flow Systems Group.

DETERMINING AND IMPROVING LABYRINTH SEAL PERFORMANCE IN CURRENT AND ADVANCED HIGH PERFORMANCE GAS TURBINES

Harold L. Stocker *In* AGARD Seal Technol. in Gas Turbine Eng. Aug. 1978 22 p refs (For primary document see N79-11056 02-07)

(Contracts NAS3-20056; N00140-73-C-005; N00140-74-C-0759)

Avail: NTIS HC A13/MF A01 CSCL 21E

Abradable and honeycomb lands were evaluated with a conventional straight-through seal using a static two dimensional (rectangular flowpath) seal rig and a rotating three dimensional seal rig. Test results show that some abradable lands leak significantly more than a solid-smooth land. However, honeycomb lands were found to reduce leakage up to 24 percent. Through aerodynamic testing, an advanced design labyrinth seal was developed which reduced leakage 54.2 percent compared to a conventional straight-through seal and 26.3 percent compared to a conventional stepped seal. A.R.H.

N79-11069# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio. Components Branch.

FACTORS ASSOCIATED WITH RUB TOLERANCE OF COMPRESSOR TIP SEALS

Charles W. Elrod *In* AGARD Seal Technol. in Gas Turbine Eng. Aug. 1978 12 p refs (For primary document see N79-11056 02-07)

Avail: NTIS HC A13/MF A01

Air Force facilities for investigating different facets of the problem of ineffective tolerance of compressor blade tip seals to high speed rubs are described and the integration of the test data in the overall rub tolerance program is delineated. A compressor rub test facility (CRTF) including a single compressor stage driven by an electric motor drive is used to study rub interaction in a realistic compressor environment. The apparatus is unique in its capability to provide a full range of compressor operating conditions and rub interaction rates for a full scale tip seal configuration. A laser test facility is used to examine the phenomena of self sustained combustion of titanium in a simulated compressor environment, especially the environment involved in the CRTF. The burn rate and damage criteria is used to develop proper procedures for safe test operation. The pressure, temperature, and velocity relationships on self sustained combustion of titanium are noted to have significant relevance to many situations outside the CRTF environment. A.R.H.

N79-11070*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SELF-ACTING SHAFT SEALS

Lawrence P. Ludwig *In* AGARD Seal Technol. in Gas Turbine Eng. Aug. 1978 29 p refs (For primary document see N79-11056 02-07)

Avail: NTIS HC A13/MF A01 CSCL 13I

The operating principle and design of the self-acting seal is reviewed. Mathematical models for obtaining a seal force balance and the equilibrium operating film thickness are outlined. Particular attention is given to primary ring response (seal vibration) to rotating seat face runout. This response analysis reveals three different vibration modes with secondary seal friction being an important parameter. Leakage flow inlet pressure drop and affects of axisymmetric and nonaxisymmetric sealing face deformations are discussed. Experimental data on self-acting face seals operating under simulated gas turbine conditions are given; these data show the feasibility of operating the seal at conditions of 345 N sq cm (500 psi) and 152 m/sec (500 ft/sec) sliding speed. Also, a spiral groove seal design operated to 244 m/sec (800 ft/sec) is described. A.R.H.

N79-11071# Pisa Univ. (Italy). Istituto di Macchine.

SELF ACTIVE PAD SEAL APPLICATION FOR HIGH PRESSURE ENGINES

Dino Dini *In* AGARD Seal Technol. in Gas Turbine Eng. Aug. 1978 10 p refs (For primary document see N79-11056 02-07)

Avail: NTIS HC A13/MF A01

A more effective and improved engine sealing system is analyzed and discussed for application to an advanced high pressure engine. Very high leakage in labyrinth seal applied at high pressure and temperature locations of high performance engines is overcome by a self-acting lift pad seal added to the primary sealing surface, enabling a very thin gas film separation of the surfaces during shaft rotation. Details of construction and design to operate at a clearance less than 1/10th that associated with labyrinth seals are given. Operation was obtained at a rotating speed of 600 ft/sec and a sealed air temperature of 600 F. The maximum speed and pressure capability is at present tested for use in high-pressure engine applications. A.R.H.

N79-11072# Rolls-Royce Ltd., Derby (England). Technical Design Group.

GAS TURBINE DISC SEALING SYSTEM DESIGN

D. A. Campbell *In* AGARD Seal Technol. in Gas Turbine Eng. Aug. 1978 16 p refs (For primary document see N79-11056 02-07)

Avail: NTIS HC A13/MF A01

The turbine sealing system must seal the disc space against ingress of hot turbine gases, and absorb windage and conducted heat with limited air temperature rises. Air leakage in the system must be controlled to minimize engine performance losses, to avoid loss of blade cooling effectiveness and to maintain the integrity of associated shaft and bearing cooling systems. The effect of the required bleed flow on engine performance is considered and found to be fairly small provided that an accurate assessment of this offtake is made at the beginning of the design process. Subsequent increases of the air bleed during the development phase can bring substantial penalties in turbine entry temperature. The various factors to be considered when determining the sealing and cooling flows are reviewed and the areas where further research would be useful are indicated. Author

N79-11073# British Hydromechanics Research Association, Cranfield (England).

A COMPUTATIONAL TOOL FOR MECHANICAL SEAL DESIGN

B. S. Nau and R. T. Rowles *In* AGARD Seal Technol. in Gas Turbine Eng. Aug. 1978 10 p. refs (For primary document see N79-11056 02-07)

Avail: NTIS HC A13/MF A01

The significance and treatment of various factors affecting the performance of rotary mechanical seals are discussed as well as their incorporation into a computer program developed for design purposes. Topics covered include: surface topography, interfacial film dynamics, with caviation allowed for; self-generated heat; thermal distortion; and distortion from sealed pressure. The program structure is outlined. A.R.H.

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N79-11074*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SPINEQ: A PROGRAM FOR DETERMINING AIRCRAFT EQUILIBRIUM SPIN CHARACTERISTICS INCLUDING STABILITY

William M. Adams, Jr. Nov. 1978 86 p refs

(NASA-TM-78759; L-12328) Avail: NTIS HC A05/MF A01 CSCL 01C

A computer program, SPINEQ, is described which can algebraically solve the nonlinear equations of motion for equilibrium spin conditions. Linear characteristics of the airplane about the equilibrium points are also determined. The theoretical basis of the program is outlined, computational flow is shown, the functions of major subroutines are described, and key parameters directing the computations are identified. Program input and output are described and illustrated by means of a test case. The program is available from COSMIC. Author

N79-11075# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugfuehrung.

A CONTRIBUTION TO THE INCREASE OF AIRCRAFT GUIDANCE PRECISION UNDER WIND DISTURBANCE CONDITIONS BY USING DIRECT DIGITAL CONTROL
Hans Gerd Schlueter and Klaus Bender 14 Nov. 1977 40 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-506)
(DLR-FB-77-48) Avail: NTIS HC A03/MF A01; DFVLR, Cologne DM 20.70

The application of direct digital control for aircraft control is proposed. Using this technique, no aerodynamic states are considered for the invariance conditions against wind and gust disturbances. Thus, high accuracy for path holding and tracking can be achieved. A simple iteration-procedure calculates the control input necessary to compensate the influence of wind on the commanded aircraft acceleration. The inverse solutions of the nonlinear and coupled equations of forces and moments were determined on-line using an airborne digital computer. The sensitivity to parameter changes was reduced by additional feedback and adaptation loops. Author (ESA)

N79-11076# European Space Agency, Paris (France).
INVESTIGATIONS FOR THE CALCULATION OF ROBUST CONTROL SYSTEMS
R. Steinhauser Jun. 1978 30 p refs Transl. into ENGLISH of 'Untersuch. zur Berechnung robuster Regelungsysteme', DFVLR, Oberpfaffenhofen, West Ger. Report DLR-IB-552-77/41, Nov. 1977
(ESA-TT-488; DLR-IB-552-77/41) Avail: NTIS HC A03/MF A01

Robust control systems, i.e., stabilizing systems which do not lead to instability at the occurrence of a failure without duplication and switching over, are discussed. Two procedures for the calculation of a robust controller are presented in which the stability criteria of Hurwitz and the Riccati equation are applied respectively. With the latter procedure a robust controller for a simple system was calculated. Author (ESA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N79-11077# ARO, Inc., Arnold Air Force Station, Tenn.
DESIGN AND EVALUATION OF A LASER DOPPLER VELOCIMETER FOR THE AEDC-PWT 4-FOOT TRANSONIC TUNNEL Final Report, Jul. 1976 - Oct. 1977
F. L. Crosswy, D. B. Brayton, H. T. Kalb, and J. H. Brewer AEDC Jul. 1978 61 p refs
(AD-A057327; AEDC-TR-78-30) Avail: NTIS HC A04/MF A01 CSCL 14/2

The design details and initial performance evaluation of a two-component laser Doppler velocimeter LDV system for a large transonic wind tunnel are presented. The two-color, backscatter LDV was specially developed for freestream, pitch plane flow angle and velocity magnitude measurements using only intrinsic particulate matter as light scatterers. An environmental control system and remote optical alignment techniques were developed since the LDV was located in the hostile environment - vibration, vacuum, inaccessibility, etc. of the tunnel plenum region. A new type LDV signal processor was developed to process the low-level signals produced by the small intrinsic particles. A versatile, computer-based system was developed for high-speed data acquisition. LDV mean velocity and flow angle data are compared to freestream velocity data and aerodynamic flow angle probe data. Author (GRA)

N79-11078# California Univ., Livermore. Lawrence Livermore Lab.
WIND TUNNEL WALL COATING BY LIQUID DROPLETS INJECTED IN HIGH INTENSITY TURBULENT GAS FLOW
A. C. Buckingham 3 Mar. 1978 9 p refs Presented at ARO Workshop on Multiphase Flows, Aberdeen Proving Ground, Md., 1 Feb. 1978
(Contract W-7405-eng-48)
(UCRL-80843; Conf-780242-1) Avail: NTIS HC A02/MF A01

Numerical simulations are applied to investigate liquid droplet flight, dispersal, penetration, and interaction with a wall boundary layer in turbulent incompressible wind tunnel flow. To prevent droplet wall-surface wetting, the tunnel walls are heated. Calculated phase change, temperature change, and alteration of certain boundary layer profiles in response to droplet boundary layer interaction coincident with prescribed wall heating are summarized. DOE

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N79-11079 Drexel Univ., Philadelphia, Pa.
CONTAINERLESS MELTING AND SOLIDIFICATION OF METALS AND ALLOYS IN THE TERRESTRIAL AND SPACE ENVIRONMENTS Ph.D. Thesis
Gerald Wouch 1978 172 p
Avail: Univ. Microfilms Order No. 7817992

The first structural and thermal examination of the solidification of metals and alloys in the absence of crucible walls is reported. This was accomplished in the terrestrial environment and the microgravity environment of space. In order to accomplish containerless solidification terrestrially, an apparatus combining the techniques of electromagnetic levitation and electron beam heating was constructed. This provided independent control of levitation and heating. With this apparatus, tungsten was melted and solidified while being levitated. In order to accomplish containerless solidification in the microgravity environment of space, an apparatus was constructed to melt metals and alloys by induction heating and to allow then to solidify while floating, weightless, with little disturbance of the melt. Dissert. Abstr.

N79-11080# Battelle Inst., Frankfurt am Main (West Germany).
STUDY OF THE POSITIONING OF SOLID AND LIQUID MATERIALS IN NEAR ZERO GRAVITY ENVIRONMENTS BY ELECTROSTATIC FIELDS
E. G. Lierke, D. Langbein, and R. Grossbach Paris ESA Apr. 1978 110 p refs
(Contract ESTEC-3282/77-F-HGE(SC))
(BF-R-63.446-1; ESA-CR(P)-1081) Avail: NTIS HC A06/MF A01

Theoretical and experimental investigations of an electrostatic positioning device for containerless processing of solid and liquid samples in space were made. The positioning is based on the capacitive sensing and force principle which allows a position control of the sample in an automatic feedback loop. The sample is centered in a tetrahedral configuration of four spherical electrodes having about the same diameter as the sample. External accelerations of the order 0.001 to 0.01 g sub N can be compensated with a supply voltage of about 5 kV. The device can be operated in inert or noble gas atmosphere of either low pressure or high pressure. Temperatures up to 1500 C are feasible. Two preliminary designs of a processing chamber for low and high pressure operation are given. Both types are to be adapted to the existing space furnaces (isothermal heating facility and arc image furnace). The electronic hardware was designed, built, and functionally tested successfully. Author (ESA)

N79-11081# European Space Agency, Paris (France).
EXTREME UV/X-RAY SURVEY SATELLITE MISSION. REPORT ON PHASE A STUDY
27 Apr. 1978 91 p refs
(ESA-DP/PS(78)-12) Avail: NTIS HC A05/MF A01

The phase A study of an extreme ultraviolet (EUV, wavelength range 100 to 1000 A) / soft X ray (XUV, 15 to 250 A) survey satellite (EXUV) for all-sky survey of stellar sources is reported. Two independent grazing incidence telescopes of the nested Wolter type, each of 60 cm aperture are proposed. The focal plane package of the EUV telescope consists of a micro-channel

plate detector and a set of optimized bandpass filters (140 to 280 A, 170 to 490 A, 400 to 570 A, 475 to 715 A), providing 4 color photometry. The XUV focal plane package contains a thin (15 to 250 A) and a thick (15 to 150 A) window position-sensitive proportional counter and a gas scintillation proportional counter. Because of the better spectral resolution, the lastmentioned detector will be used for more detailed spectral studies of the diffuse XUV emission. The mission concept envisages a spinning spacecraft launched into a two-day highly eccentric equatorial orbit (apogee 120,000 km) by Ariane using a dual launch configuration. All-sky survey is achieved by mounting the telescope axes perpendicular to the spin axis of the body-stabilized spacecraft. The axis is pointed to the sun at the perigee of the orbit by a precession maneuver, giving a series of slightly overlapping great circle scans. For extended observations of particular sources, a 30 deg offset capability is included. Data is transmitted in real time at a constant rate via an experiment buffer to ESA ground stations. Author (ESA)

N79-11082# European Space Agency, Paris (France).
SPACE ASTROMETRY: HIPPARCOS. REPORT ON PHASE A STUDY
26 Apr. 1978 82 p
(ESA-DP/PS(78)-13) Avail: NTIS HC A05/MF A01

The phase A study of the HIPPARCOS (High Precision Parallax Collecting Satellite) satellite is reported. The scientific objective of the proposed mission is the accurate measurement of the astrometric parameters of celestial bodies, leading to one or two orders of magnitude improvement over the present knowledge with respect to coordinate precision, number of observed objects, limiting brightness and execution time. Direct results and indirect benefits of the mission are described. The proposed satellite will be injected into transfer orbit by Ariane in a dual configuration. The final orbit of the astrometric satellite is circular, geosynchronous, at an equatorial inclination of 20 deg or less. Continuous telecommand and telemetry links will be maintained during the whole lifetime (nominally 2.5 years) using only one European ground station. The principle applied for determining the astrometric parameters consists in measuring with high precision the angular distance between stars separated by a large angle, of the order of 70 deg. The measurements are obtained by a differential method, comparing in the focal plane of a Baker-Schmidt telescope the positions of stars imaged from two different fields of view, superimposed by means of a complex mirror with two reflecting surfaces. The attitude of the satellite is controlled in such a way that the telescope fields of view scan the whole celestial sphere in a smooth motion. Author (ESA)

N79-11083# European Space Agency, Paris (France).
REPORT PRESENTED TO THE TWENTY-FIRST COSPAR MEETING
R. D. Andresen, comp., F. Beeckmans, comp., A. C. Durney, comp., B. Feuerbacher, comp., K. Knott, comp., F. Macchetto, comp., K.-P. Wenzel, comp., R. D. Wills, comp. et al May 1978 288 p refs Conf. held at Innsbruck, Jun. 1978
(ESA-SP-1007) Avail: NTIS HC A13/MF A01

Missions, experiments, and results (partly preliminary) are summarized for the following satellites: HEOS 2, TD-1, ESRO 4, COS-B, GEOS 1, ISEE, Meteosat 1, and IUE. Five other scientific missions under development for launches between 1978 and 1983 described are: GEOS 2, first Spacelab payload, Exosat, out-of-ecliptic/solar polar mission, and ESA's participation in the NASA space telescope program. The Firewheel experiment, a project developed outside ESA as a passenger payload for a development flight of the Ariane launcher, is briefly mentioned. A bibliography on most ESA satellites is appended. ESA

N79-11084# Aeritalia S.p.A., Torino (Italy). Space Div.
ASTROMETRY SATELLITE PHASE A STUDY. VOLUME 1: TECHNICAL STUDY Final Report
Paris ESA 9 Mar. 1978 366 p 2 Vol.
(Contract ESA-3234/77-F-HGE(SC))
(ESA-CR(P)-1089-Vol-1) Avail: NTIS HC A16/MF A01

A synthesis of the results obtained is given together with an analysis and technical description of the payload. A synthetic analysis of mission and system aspects is also presented. Conclusions concerning the spacecraft support subsystems are exposed in detail. Satellite specifications are: launcher Ariane; allowed weight 640 kg max; maximum inclination of solar paddles 40 deg; and use of S-band communication. The telescope proposed is an all reflecting Baker-Schmidt with an entrance pupil of zero located at 1300 mm of the prime mirror, overall view field appr. 47 arcmins. The complex mirror will be placed at the entrance pupil, basic angle 70 deg constant within 0.001 arcsec over 20 mins of time. Author (ESA)

N79-11085# Aeritalia S.p.A., Torino (Italy). Space Div.
ASTROMETRY SATELLITE PHASE A STUDY. VOLUME 2: TECHNICAL STUDY (APPENDICES) Final Report
Paris ESA Mar. 1978 419 p 2 Vol.
(Contract ESA-3234/77-F-HGE(SC))
(ESA-CR(P)-1089-Vol-2) Avail: NTIS HC A18/MF A01

A detailed analysis of some areas of the study is presented. Mission aspects include orbital analysis, baffling, and celestial observations. Attitude and orbit control topics are coordinate reference system and perturbing torques; wheel sizing; wheel friction model; wheel static and dynamic imbalance; gyro; rate integrating gyro noise effects; control system stability; influence of observation time on jitter; gas jets choice; thruster pulses and momentum unloading; and active nutation damping. Data handling aspects such as attitude reconstitution, experimental data processing, bit rates and on-board processing options and influence of shape of star image on star position are dealt with. Communication aspects include TC & TM budgets, link power budgets, onboard computer description and S-band antenna. An optical study of the Baker-Schmidt solution for the astrometric telescope is also presented. ESA

N79-11086# European Space Agency, Paris (France).
ELECTROPHORESIS EXPERIMENT MA-014 IN THE APOLLO SOYUZ TEST PROJECT. PART 1: SCIENTIFIC RESULTS
Kurt Hannig, Hans Wirth, Dieter Leihener, Roland Loeser, and Werner Dersch Sep. 1978 41 p refs Transl. into ENGLISH of 'Elektrophorese-Expt. MA-014 im Apollo-Sojus-Test-Proj. Teil 1: Wiss. Ergeb.', Max-Planck-Inst. fuer Biochem., Martinsried bei Muenchen, West Ger. Report BMFT-FB-W-77-02, Sep. 1977 Original report in GERMAN previously announced as N78-22129 Original German report available from ZLDI, Munich DM 6.75
(ESA-TT-471; BMFT-FB-W-77-02) Avail: NTIS HC A03/MF A01

Results are presented of the free flow electrophoresis experiment on cell materials carried out during the Apollo Soyuz Test Project. For physical reasons (gravitation dependent thermoconvection and sedimentation) the ground application of the method is restricted with regard to throughput (liquid flow rate) and dissolution (selectivity). In a state of weightlessness, as in space, both values can be improved. This is confirmed by the electrophoresis experiment used in the Apollo Soyuz Test Project for separation of four biological samples (cell combinations). Author (ESA)

N79-11087# European Space Agency, Paris (France).
ELECTROPHORESIS EXPERIMENT MA-014 IN THE APOLLO SOYUZ TEST PROJECT. PART 2: TECHNICAL ASPECTS
Erhard Schoen, Guenter Dorl, and Hans Juergen Lemke Sep. 1978 46 p refs Transl. into ENGLISH of 'Elektrophorese-Expt. MA-014 im Apollo-Sojus-Test-Proj. Teil 2: Tech. Aspekte', MBB, Munich Report BMFT-FB-W-77-03, Sep. 1977 Original report in GERMAN previously announced as N78-22130 Original German report available from ZLDI, Munich DM 8.40
(ESA-TT-472; BMFT-FB-W-77-03) Avail: NTIS HC A03/MF A01

The design and onboard operation of the free flow electrophoresis experiment in the Apollo Soyuz Test Project are outlined. The apparatus has a weight of 26 kg and a power consumption of 300 W. It was used to record pherograms for a total of four biological samples. The experiment sequence was automatically controlled. Author (ESA)

N79-11088# European Space Agency, Paris (France).
ELECTROPHORESIS EXPERIMENT MA-014 IN THE APOLLO SOYUZ TEST PROJECT. PART 3: FUTURE APPLICATIONS
Erhard Schoen, Guenter Dorl, and Hans Juergen Lemke Sep. 1978 148 p refs Transl. into ENGLISH of 'Elektrophorese-Expt. MA-014 im Apollo-Sojus-Test-Proj. Teil 3: Zukuenftige Verwen-

dungsmoeglichkeiten', BMM, Munich Report BMFT-FB-W-77-04, Sep. 1977 Original report in GERMAN previously announced as N78-22131 Original German report available from ZLDI, Munich DM 25.85
(ESA-TT-473; BMFT-FB-W-77-04) Avail: NTIS HC A07/MF A01

In view of future mission objectives, the Apollo Soyuz Test Project (ASTP) configuration of the experiment does not appear suited for use in Spacelab. Instead, an experiment to be flown aboard sounding rockets (TEXUS) is presented which serves to verify the ASTP results and to test components of the Spacelab equipment. On the basis of this ASTP configuration, and taking into account the necessary modifications and required performance characteristics, and electrophoresis equipment suited for use in Spacelab was conceived, together with a schedule and cost estimate for the manufacture of the components. A configuration to be used on the pallet of the Shuttle (without Spacelab) is considered. Such a use is of interest because of the considerably higher number of launches possible and the lower costs of launching. Owing to the absence of the Spacelab periphery (atmosphere, power supply, computer, etc.) both the cost of production of such equipment and the cost for specimen analysis are substantially higher than the comparable costs related to the Spacelab configuration, so that it is recommended to abandon this possibility. Author (ESA)

N79-11089# Erno Raumfahrttechnik G.m.b.H., Bremen (West Germany). Hauptabt. Vorprojekte und Studien (PRV).
THE USE OF SPACELAB TYPE ELEMENTS WITHIN POSSIBLE STEPS TOWARDS A SPACE PLATFORM Final Report
P. Natenbruk, F. Kowalke, L. Schulte, H. Friedrich, I. Meyer, H. J. Heidmann, W. Gericke, A. Ward, and W. Mukrowsky Paris ESA Apr. 1978 343 p refs
(Contract ESA-3209/77-F-HEW(SC))
(PRV-6-2/78; ESA-CR(P)-1093) Avail: NTIS HC A15/MF A01

The extension of the Space Transportation System resources and capabilities through European contributions based on Spacelab elements or Spacelab derived hardware and technology was studied. Topics include reference program description; Spacelab's role within the reference program; analysis of Spacelab changes and impacts with up to 30 days mission duration capacity; power module supported sortie mission duration; analyses of increased power and heat rejection capability and the associated Spacelab impacts; the free flyer system; and attachment and module to a space station. ESA

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N79-11090*# Remtech, Inc., Huntsville, Ala.
RESEARCH STUDY: THERMAL CURTAIN PERMEABILITY AND THERMAL RESPONSE TEST FOR SRB REENTRY Final Report
Charles E. Fuller, James K. Levie, III, and Robert T. Powell Nov. 1978 71 p
(Contract NAS8-32997)
(NASA-CR-150847; RTR-035-1) Avail: NTIS HC A04/MF A01 CSCL 22B

Nine inch diameter samples of the material which will provide thermal and acoustic protection between the nozzle and outer skirt on the space shuttle solid rocket boosters were subjected to heating tests to determine the porosity of the material and the thermal response to a step change in heating. For the porosity measurements a steady state flow of air at 70 F, 500 F, and 1000 F was passed through a sample of the curtain material and measurements of the flow rates were made at different pressure drops across the sample. For the transient measurements, a sample of the curtain material was subjected to a step change in temperature as air was passed through the sample. Measurements of the heat flow through the sample were made as a function of time after the input of the heat pulse. The sample consisted of three layers of curtain panels. Each panel was made of combinations of quartz and fiberglass cloth between which a fiberfrax filler material had been stitched. The hardware design and test procedures were described. Data are provided in engineering units for the flow conditions and and temperatures at which measurements were conducted A R H

N79-11091# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil)
ORBSAT: A PRECISION SYSTEM FOR CALCULATING SATELLITE ORBITS [ORBSAT: UM SISTEMA DE PRECISAO PARA O CALCULO DE ORBITAS DE SATELITES]
Jose Antonio Goncalves Pereira, Paulo Henrique de Assis Santana, and Luiz Gylvan Meira Filho Sep 1978 12 p In PORTUGUESE Presented at the 5th Congr. Integrado de Hardware e Software Nacionais, Rio de Janeiro, Jul. 1978
(INPE-1357-PE/166) Avail: NTIS HC A02/MF A01

A system which calculates satellite orbits as well as instantaneous position using a predictor corrector method is described. General descriptions of physical input/output data are given. Transl. by B B

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

N79-11092# European Space Agency, Paris (France).
STUDY OF HYDRAULIC GENERATORS FOR VIBRATION TESTING OF LARGE SPACE MODULES
Merlet and Lemonde Aug. 1978 117 p Transl. into ENGLISH of 'Etudes des Generateurs Hydraulique pour les Essais aux Vibrations d'Objets Spatiaux de Grandes Dimensions', SOPEMEA, Toulouse Report ESA-CR(P)-1044, 24 Nov. 1977 Original report in FRENCH previously announced as N78-28145
(ESA-TT-492; ESA-CR(P)-1044) Avail: NTIS HC A06/MF A01

Test equipment necessary for future payloads of Ariane and Spacelab is discussed. The state of the art of vibration simulation techniques using hydraulic exciters is presented. Phase 1 of the study deals with the search for high power installations. In phase 2 the available facilities and their limitations are discussed. Phase 3 is concerned with safety systems and with the studies to be undertaken in order to improve existing installations. ESA

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N79-11093*# General Electric Co., Philadelphia, Pa. Space Div.
SKYLAB VISCOUS DAMPER STUDY Final Report
Nov. 1978 19 p
(NASA Order H-34352-B)
(NASA-CR-150845; Doc-78SDS54251) Avail: NTIS HC A02/MF A01 CSCL 22B

The proposed magnetically anchored viscous fluid damper can maintain the Skylab in a gravity-gradient stabilized mode at the anticipated reboost altitudes. The parameters influencing damper performance (and thereby affecting the degree of risk) are: (1) amount of skylab pitch bias in the orbit plane which will result from aerodynamic trim conditions of the post-reboost configuration Skylab; (2) the lowest altitude to which the post-reboost Skylab will be allowed to decay prior to the next rendezvous; (3) maximum allowable weight and size of the

proposed damper in order to match shuttle/TRS mission constraints (4) the amount of magnetic materials expected to be in the vicinity of the damper J.A.M

N79-11094# Dornier-System G.m.b.H., Friedrichshafen (West Germany)

SEOCS. SUN EARTH OBSERVATORY AND CLIMATOLOGY SATELLITE, PHASE A STUDY: EXECUTIVE SUMMARY Final Report

E. Bachor. Paris ESA Apr. 1978 39 p 3 Vol.
(Contract ESTEC-3195/77-NL-PP(SC))
(ESA-CR(P)-1084-Vol-1) Avail: NTIS HC A03/MF A01

The main study objectives can be summarized as follows: investigation of suitable spacecraft configurations; performance of trade-offs on system and subsystem level including mission and cost aspects; selection and justification of the preferred system concept; detailed analysis of the selected configuration; system and subsystem design; refined payload accommodation; definition of the model philosophy; preparation of the development plan; and provision of realistic cost estimates. Author (ESA)

N79-11095# Dornier-System G.m.b.H., Friedrichshafen (West Germany)

SEOCS. SUN-EARTH OBSERVATORY AND CLIMATOLOGY SATELLITE, PHASE A STUDY: TECHNICAL RESULTS Final Report

E. Bachor, W. Trogus, L. Borucki, M. Granzow, E. Hanka, A. Kopsch, R. Nord, R. Ockert, F. Pittermann, H. Raupp et al. Paris ESA Mar. 1978 340 p refs Prepared jointly with BAC and DFVLR 3 Vol.
(Contract ESTEC-3195/77-NL-PP(SC))
(ESA-CR(P)-1084-Vol-2) Avail: NTIS HC A15/MF A01

System trade-offs and a preferred design of the SEOCS satellite are presented. Based on the description of the selected orbit the various parameters including their variations were derived. Launch aspects and orbit determination methods are discussed. The requirements of the scientific payload, consisting of six different instruments, are presented and the corresponding functional principle as well as the present design are described. Together with the necessary filter wheel the payload has been accommodated on one platform within the satellite. The basic spacecraft requirements are evaluated followed by the investigation of a number of suitable configurations. By means of an intensive system level trade-off these solutions were compared and assessed, resulting in a selection of the preferred concept. The design of the subsystems is outlined comprising requirements and baseline layout as well as alternative solutions where appropriate. The various operational phases, the control center, and the first concept of a mission operations plan are discussed. Author (ESA)

N79-11096# Dornier-System G.m.b.H., Friedrichshafen (West Germany).

SEOCS. SUN-EARTH OBSERVATORY AND CLIMATOLOGY SATELLITE, PHASE A STUDY: SCANNING RADIOMETER FEASIBILITY Final Report

James W. Hoffman. Paris ESA Mar. 1978 47 p refs 3 Vol.
(Contract ESTEC-3195/77-NL-PP(SC))
(ESA-CR(P)-1084-Vol-3) Avail: NTIS HC A03/MF A01

The feasibility of a scanning radiometer to be used on SEOCS was studied. The scanning radiometer is a radiation budget instrument with 50 km spatial resolution at nadir and a radiometric accuracy of approximately 0.5 %. The radiometer will measure reflected and emitted energy from every spot on earth at varying look angles. It will thus provide the data to determine the total outgoing flux from the earth and its spectral distribution. The SEOCS spacecraft employs spacecraft yawing (rotation around the nadir line) to maintain the solar panels oriented towards the sun. A strong preference was therefore presented for a radiometer design that would be insensitive to a slow yaw motion of the satellite. The design concept selected as the baseline is a rotating instrument. It employs 8 cm Ritchey-Chretien optics and a simple object plane stepping mirror. Spectral separation is performed by means of a reflecting chopper and 2 sets of narrow detectors from which the signal is integrated up over a 50 km distance in the scan direction. Author (ESA)

N79-11097# Compagnia Nazionale Aerospaziale C.N.A. S.p.A., Rome (Italy).

FEASIBILITY AND PREDEFINITION STUDY OF A METEOROLOGICAL DATA DISTRIBUTION AND LASSO MISSION USING A SIRIO BUS, PHASE A Final Report

Paris ESA 14 Mar. 1978 291 p 6 Vol.
(Contract ESA-3472/78-F-CG-SC)
(X-TR-001-Vol-1; ESA-CR(P)-1074-Vol-1) Avail: NTIS HC A13/MF A01

The possibility of a meteorological data distribution and a laser clock synchronization mission on a SIRIO-2 bus was studied. The feasibility of the two missions is demonstrated and a preliminary definition of both is given. The spacecraft configuration is described, and layout, mass breakdown, inertial characteristics, and equipment characteristics are given for two options (one with PDM, one with PCM command). Mission analysis, launch operations, product assurance, component procurement, and development plan are also covered. Author (ESA)

N79-11098# Compagnia Nazionale Aerospaziale C.N.A. S.p.A., Rome (Italy).

FEASIBILITY AND PREDEFINITION STUDY OF A METEOROLOGICAL DATA DISTRIBUTION AND LASSO MISSION USING A SIRIO BUS, PHASE A. ANNEX 1: MDD MISSION Final Report

Paris ESA 14 Mar. 1978 195 p 6 Vol.
(Contract ESA-3472/78-F-CG-SC)
(X-TR-001-Vol-2; ESA-CR(P)-1074-Vol-2) Avail: NTIS HC A09/MF A01

The Meteorological Data Distribution (MDD) mission to be flown on SIRIO-2 was studied. The aim of the MDD mission is to repair the deficiencies in the African communications network and thus increase the effective contribution of that part of the globe to world wide meteorology. Topics include mission definition and analysis; link budgets versus satellite antenna and ground station performance; frequency plan, IF processor, satellite antenna and power amplifier tradeoffs; characteristics of ground stations; system synthesis; demodulating - remodulating repeater approach; MDD linear repeater approach; and test equipment. ESA

N79-11099# Compagnia Nazionale Aerospaziale C.N.A. S.p.A., Rome (Italy).

FEASIBILITY AND PREDEFINITION STUDY OF A METEOROLOGICAL DATA DISTRIBUTION AND LASSO MISSION USING A SIRIO BUS, PHASE A. ANNEX 2: LASSO MISSION Final Report

Paris ESA 14 Mar. 1978 87 p 6 Vol.
(Contract ESA-3472/78-F-CG-SC)
(X-TR-001-Vol-3; ESA-CR(P)-1074-Vol-3) Avail: NTIS HC A05/MF A01

The Laser Synchronization Experiment (LASSO) mission to be flown on SIRIO-2 was studied. The aim of the LASSO experiment is to synchronize the clocks in laser ground stations using satellite communication. Topics include system analysis, error analysis, detection system, equipment study, data processing, development plan, and work plan. ESA

N79-11100# Compagnia Nazionale Aerospaziale C.N.A. S.p.A., Rome (Italy).

FEASIBILITY AND PREDEFINITION STUDY OF A METEOROLOGICAL DATA DISTRIBUTION AND LASSO MISSION USING A SIRIO BUS, PHASE A. ANNEX 3: QUALITY ASSURANCE PLAN Final Report

Paris ESA 14 Mar. 1978 103 p 6 Vol.
(Contract ESA-3472/78-F-CG-SC)
(X-TR-001-Vol-4; ESA-CR(P)-1074-Vol-4) Avail: NTIS HC A06/MF A01

The activities and services the prime contractor of the SIRIO-2 program will provide to ensure the required quality of the spacecraft and the relevant equipment during the phases of design and development, manufacturing and tests (including qualification and acceptance), shipping and delivery, and launch preparation, are presented. ESA

N79-11101# Compagnia Nazionale Aerospaziale C.N.A. S.p.A., Rome (Italy).

FEASIBILITY AND PREDEFINITION STUDY OF A METEOROLOGICAL DATA DISTRIBUTION AND LASSO MISSION

USING A SIRIO BUS, PHASE A. ANNEX 4: SIRIO-2 TEST PLAN Final Report
Paris ESA 14 Mar. 1978 54 p 6 Vol.
(Contract ESA-3472/78-F-CG-SC)
(X-TR-001-Vol-5; ESA-CR(P)-1074-Vol-5) Avail: NTIS HC A04/MF A01

The technical planning of the system activities on the SIRIO 2 satellite mechanical model, engineering model, and flight unit is presented. It covers the period from subsystems delivery to the completion of flight acceptance of the flight unit model. Technical test details are included. ESA

N79-11102# Compagnia Nazionale Aerospaziale C.N.A. S.p.A., Rome (Italy).
FEASIBILITY AND PREDEFINITION STUDY OF A METEOROLOGICAL DATA DISTRIBUTION AND LASSO MISSION USING A SIRIO BUS, PHASE A. ANNEX 5: GSE PERFORMANCE Final Report
Paris ESA 14 Mar. 1978 58 p 6 Vol.
(Contract ESA-3472/78-F-CG-SC)
(X-TR-001-Vol-6; ESA-CR(P)-1074-Vol-6) Avail: NTIS HC A04/MF A01

A survey of the ground support facilities and instruments available at CNA is presented. ESA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation.*

N79-11103*# Remtech, Inc., Huntsville, Ala.
SPACE SHUTTLE PLUME SIMULATION EFFECT ON AERODYNAMICS Final Report
Leroy M. Hair Oct. 1978 66 p refs
(Contract NAS8-29751)
(NASA-CR-150848; RTR-016-5) Avail: NTIS HC A04/MF A01 CSCL 22B

Technology for simulating plumes in wind tunnel tests was not adequate to provide the required confidence in test data where plume induced aerodynamic effects might be significant. A broad research program was undertaken to correct the deficiency. Four tasks within the program are reported. Three of these tasks involve conducting experiments, related to three different aspects of the plume simulation problem: (1) base pressures; (2) lateral jet pressures; and (3) plume parameters. The fourth task involves collecting all of the base pressure test data generated during the program. Base pressures were measured on a classic cone ogive cylinder body as affected by the coaxial, high temperature exhaust plumes of a variety of solid propellant rockets. Valid data were obtained at supersonic freestream conditions but not at transonic. Pressure data related to lateral (separation) jets at M infinity = 4.5, for multiple clustered nozzles canted to the freestream and operating at high dynamic pressure ratios. All program goals were met although the model hardware was found to be large relative to the wind tunnel size so that operation was limited for some nozzle configurations. B.B.

N79-11104# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany).
FEASIBILITY STUDY OF A SPACELAB EXPERIMENTAL PROPULSION PLATFORM Final Report
Detlef Manski and Peter Natenbruk (Erno Raumfahrttech. GmbH, Bremen) Dec. 1977 457 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-495)
(Contract BMFT-WRT-1075; BPT-01-QV-116)
(BMFT-FB-W-77-47) Avail: NTIS HC A20/MF A01; ZLDI, Munich DM 96

A feasibility study of a small Spacelab experiment propulsion platform which could be specially designed to accomodate small free-flying shuttle payloads was made. The orbit maneuvering propulsion system of the platform would economically utilize a monopropellant hydrazine system, while the eight attitude control thrusters of this fully three-axis stabilized system would use cold gas. The energy supply and telemetry/telecommand systems for the platform would be carried on-board, but due to the broad applicability of the design the energy for each payload cannot be provided by the platform. The platform can remain completely stabilized for a longer time in space, can execute orbit maneuvers, and can then return under its own power to the shuttle. Lightweight construction for the platform as well as highly energetic propulsion systems are unnecessary due to the relatively small specific shuttle costs. Thus it is possible to manufacture the platform cheaply, and more frequent utilization for the many free-flying shuttle experiments of the 80's will be possible. Author (ESA)

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications.*

N79-11105# Army Armament Research and Development Command, Dover, N. J. Technical Support Directorate.
ERROR PROBABILITY IN BINARY DIGITAL FM TRANSMISSION SYSTEMS
William Donnally Feb. 1978 29 p refs
(AD-A056237; AD-E400090; ARTSD-TR-77006) Avail: NTIS HC A03/MF A01 CSCL 09/6

The information presented in this report concerns the analysis of error probability in various binary, digital, frequency modulated (FM) transmission systems operating in the presence of additive noise. The actual error producing mechanism, associated with digital FM modulation techniques, is analyzed. This report will aid the design engineer in determining the advantages and disadvantages associated with each type of modulation and the particular advantages of using angular feedback demodulation of frequency shift keying (FSK) by means of phase-lock loops. Author (GRA)

N79-11106# California Univ., Livermore. Lawrence Livermore Lab.
FIBER OPTIC TELEMETRY SYSTEM FOR LLL HIGH-VOLTAGE TEST STAND
J. P. Richter Oct. 1977 6 p Presented at 7th Symp. on Fusion Res. Proj., Knoxville, Tenn.
(Contract W-7405-eng-48)
(UCRL-79688; Conf-771029-79) Avail: NTIS HC A02/MF A01

The fiber optic telemetry system designed to operate in the hostile particle and electromagnetic radiation environment of the high voltage test stand is described. System criteria, components, packaging, and performance are discussed. In all tests to date, the system exceeds its design goals with very comfortable margins. DOE

N79-11107# Sandia Corp., Livermore, Calif. Post Development Testing Div.
ADAPTIVE TELEMETER M.S. Thesis - Calif. Univ., Davis
A. W. Kellom Jun. 1978 54 p refs
(Contract EY-76-C-04-0789)
(SAND-78-8013) Avail: NTIS HC A04/MF A01

Telemetry data were the single most important source of information for missile system evaluation. Current telemetry systems encoded data on launch environment, launch and stage ignition, reentry vibration, steering commands, final guidance, background data, and impact using fixed-format encoders. These fixed-format encoders assigned to each signal a portion of the data bandwidth, which remained committed throughout the missile flight regardless of the presence or absence of information. Because bandwith was limited, data requirements were sometimes compromised to fit the encoder capacity. Also telemetry redesign in case of changing requirements, was expensive and time-comsuming. Methods by which these problems can largely be solved were considered. Through the use of onboard microproces-

sors, data can be sent immediately or stored for later transmission thus better using available bandwidth. Transmission frequencies can be varied according to need and the phase of missile trajectory. DOE

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N79-11108* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

APPARATUS FOR ASSEMBLING SPACE STRUCTURE Patent

James D. Johnston, Richard H. Tuggle, Jr., John L. Burch, and Keith H. Clark, inventors (to NASA) Issued 31 Oct. 1978 13 p Filed 31 Aug. 1977 Supersedes N77-31213 (15 - 22, p 2904)

(NASA-Case-MFS-23579-1; US-Patent-4,122,991; US-Patent-Appl-SN-829316; US-Patent-Class-228-13; US-Patent-Class-228-15.1; US-Patent-Class-228-173; US-Patent-Class-244-159) Avail: US Patent Office CSCL 22B

An apparatus for producing a structure in outer space from rolls of prepunched ribbon or sheet material that are transported from the earth to the apparatus located in outer space is described. The apparatus spins the space structure similar to a spider spinning a web utilizing the prepunched ribbon material. The prepunched ribbon material is fed through the apparatus and is shaped into a predetermined channel-shaped configuration. Trusses are punched out of the ribbon and are bent downwardly and attached to a track which normally is a previously laid sheet of material. The size of the overall space structure may be increased by merely attaching an additional roll of sheet material to the apparatus. Official Gazette of the U.S. Patent Office

N79-11109*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INSULATOR EDGE VOLTAGE GRADIENT EFFECTS IN SPACECRAFT CHARGING PHENOMENA

N. John Stevens, Carolyn K. Purvis, and John V. Staskus 1978 16 p refs Presented at the Ann. Conf. on Nucl. and Space Radiation Effects, Albuquerque, N. Mex., 18-21 Jul. 1978, sponsored by IEEE

(NASA-TM-78988; E-9769) Avail: NTIS HC A02/MF A01 CSCL 22B

Insulating surfaces on geosynchronous satellites were charged by geomagnetic substorms to a point where discharges occur. The electromagnetic pulses from these discharges couple into satellite electronic systems disrupting operations are examined. Laboratory tests conducted on insulator charging have indicated that discharges appear to be initiated at insulator edges where voltage gradients can exist. An experimental investigation was conducted to measure edge voltage gradients on silvered Teflon samples as they are charged by monoenergetic electron beams. It was found that the surface voltage at insulator edges can be approximated by an exponential expression based on an electron current density balance. Author

N79-11110# British Aerospace Dynamics (Space), Stevenage (England).

GUIDELINES FOR SPACECRAFT POWER AND SIGNAL CABLING

D. R. Hambleton, comp., P. E. Whitehead, comp., J. E. Williams, comp., and G. W. Jones, comp. Paris ESA Feb. 1978 331 p refs

(Contract ESTEC-2595/MP)

(ESA-CR(P)-1086) Avail: NTIS HC A15/MF A01

A guide to the design of cable harnesses is presented, the emphasis being on design rather than fabrication. Specifications most commonly used in cable harness design are presented. Guidelines for the design and installation of power, signal, and pyrotechnic harnesses are given. The emphasis is on round wire harnesses with some information on flat conductor cabling. Parametric data for the selection of wire/cable and connectors and a list of some of the manufacturers are given. Some aspects of cable harness fabrication are dealt with. Essential interface information requirements are listed. Data and formulae frequently encountered in harness design are discussed. An outline procurement specification is annexed. Author (ESA)

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N79-11111# Officine Galileo S.p.A., Florence (Italy).

DESIGN STUDY OF AN OPTICAL YAW EARTH SENSOR Final Report

A. R. Buccheri Paris ESA Mar. 1978 175 p

(Contract ESTEC-2951/76-NL-AK(SC))

(ESA-CR(P)-1072) Avail: NTIS HC A08/MF A01

The feasibiity of an electro-optical yaw sensor for a non-spinning, three axis stabilized satellite, based on the measurement of the direction of the relative movement of the spacecraft with respect to the earth, was studied. To obtain the yaw information from the sensor information it is necessary to correct the angle measurement depending on the mission type and on the position of the spacecraft in orbit. It is shown that the necessary computations for the correction of the sensor measurement require regular updating by a ground station via telecommand after some satellite orbits, depending on the stability of the orbital parameters. Two possible systems are suggested, one realized by a fixed reticle system, the other by two arrays of detectors. Only the first was analyzed in depth, the second being discarded at the beginning because of the necessity of introducing moving parts. The limits of functioning of the fixed reticle system were evaluated after an optimization based on two earth pictures taken in the 11.5 micrometer wavelength which were statistically analyzed. The final result was that at low altitudes there are wide margins in the reticle design to obtain the sensor functioning also in condition of low input signal at the expense of the time constant of the system; at high altitudes, the margins are far more restricted and a trade off between the sensor functioning at low input signal and the signal time constant of the system is not possible. Author (ESA)

N79-11112# EMI Electronics Ltd., Hayes (England). Electron Tube Div.

FURTHER WORK TO MODIFY AN EMI 2-STAGE IMAGE INTENSIFIER TO BE SUITABLE FOR A SPACEBORNE ASTRONOMICAL INSTRUMENT ON S.T. Summary Final Report

G. Ashe, R. J. Ellis, H. B. Wild, and L. A. Woodbridge Paris ESA Apr. 1978 52 p refs

(Contract ESTEC-2960/76-NL-PP(SC))

(ETD-16; ESA-CR(P)-1097) Avail: NTIS HC A04/MF A01

Investigations on increasing the ruggedness of the EMI type 9916 2-stage magnetically focused cascade image intensifier, on the extension of the spectral response into the vacuum ultraviolet region, on the resistance to a spacecraft launch and on the operation in a spaceborne astronomical instrument are reported. Methods of sealing magnesium fluoride windows to the intensifier and improving the photocathode response on this material by initial control of the photocathode activation were found. Life tests of S20 photocathodes on magnesium fluoride in test cells were carried out and no sign of deterioration was observed after 28 months. Theoretical and practical studies were made to determine the conditions likely to produce damage on 2-stage tubes due to light overload. Six ruggedized tubes incorporating magnesium fluoride windows were made. Two of these were encapsulated in low outgassing rate materials and have withstood typical spacecraft vibration, acoustic, and pressure environments. The image intensifier will be used in the Faint

Object Camera for application in the Space Telescope.
Author (ESA)

N79-11113# Societe Nationale Industrielle Aerospatiale, Cannes (France). Div. Systemes Balistiques et Spatiaux.
ATTITUDE CONTROL SYSTEM STUDY INCLUDING AN ESTIMATOR OF THE GYROMETER DERIVATIVE USING ESA ONBOARD COMPUTER, VOLUME 1 Final Report [ETUDE D'UN SYSTEME DE CONTROLE D'ATTITUDE INCLUANT UN ESTIMATEUR DE LA DERIVE DES GYROMETRES ET UTILISANT LE CALCULATEUR EMBARQUE DE L'ESA, VOLUME 1]
P. Contensou, J. P. Monnier, P. Baduel, Y. Amalberti, D. Hahn, and J. Willien Paris ESA 16 May 1978 76 p In FRENCH 2 Vol.
(Contract ESTEC-3030/77)
(Rept-483-CA-52-Vol-1; ESA-CR(P)-1095-Vol-1) Avail: NTIS HC A05/MF A01

Based on a classical attitude control system an estimator is defined capable of producing a correction to the gyrometer derivative. A study of the estimator led to a model that was tested by three axis mathematical simulation. The model was programmed for the ESA onboard computer and simulation tested. ESA

N79-11114# Societe Nationale Industrielle Aerospatiale, Cannes (France). Div. Systemes Balistiques et Spatiaux.
ATTITUDE CONTROL SYSTEM STUDY INCLUDING AN ESTIMATOR OF THE GYROMETER DERIVATIVE USING ESA ONBOARD COMPUTER, VOLUME 2 Final Report [ETUDE D'UN SYSTEME DE CONTROLE D'ATTITUDE INCLUANT UN ESTIMATEUR DE LA DERIVE DES GYROMETRES ET UTILISANT LE CALCULATEUR EMBARQUE DE L'ESA, VOLUME 2]
P. Contensou, J. P. Monnier, P. Baduel, Y. Amalberti, D. Hahn, and J. Willien Paris ESA 16 May 1978 263 p In FRENCH 2 Vol.
(Contract ESTEC-3030/77)
(Rept-483-CA-52-Vol-2; ESA-CR(P)-1095-Vol-2) Avail: NTIS HC A12/MF A01

The graphs apertaining to volume 1 are presented and the computer program, in Assembler, is listed. ESA

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N79-11115*# Battelle Pacific Northwest Labs., Richland, Wash.
DEVELOPMENT OF SPUTTERING PROCESS TO DEPOSIT STOICHIOMETRIC ZIRCONIA COATINGS FOR THE INSIDE WALL OF REGENERATIVELY COOLED ROCKET THRUST CHAMBERS
R. Busch 19 Jul. 1978 33 p refs
(Contract NAS3-19721)
(NASA-CR-159412) Avail: NTIS HC A03/MF A01 CSCL 21H

Thermal barrier coatings of yttria stabilized zirconia and zirconia-ceria mixtures were deposited by RF reactive sputtering. Coatings were 1-2 mils thick, and were deposited on copper cylinders intended to simulate the inner wall of a regeneratively cooled thrust chamber. Coating stoichiometry and adherence were investigated as functions of deposition parameters. Modest deposition rates (approximately 0.15 mil/hr) and subambient sustrate temperatures (-80 C) resulted in nearly stoichiometric coatings which remained adherent through thermal cycles between -196 and 400 C. Coatings deposited at higher rates or substrates temperatures exhibited greater oxygen deficiences, while coatings deposited at lower temperatures were not adherent. Substrate bias resulted in structural changes in the coating and high krypton contents; no clear effect on stoichiometry was observed. Author

N79-11116# Los Alamos Scientific Lab., N. Mex.
DEVELOPMENT OF PYROLYTIC GRAPHITE/SILICON CARBIDE COMPOSITE MATERIALS FOR ROCKET-NOZZLE APPLICATIONS. VOLUME 1: THE INJECTOR DEPOSITION FURNACE Final Report, 1 Jul. - 31 Dec. 1976
T. C. Wallace, G. E. Cort, J. J. Damran, and M. C. Cline Jun. 1978 213 p refs 3 Vol.
(Contracts W-7405-eng-36; F04611-76-X-003; AF Proj. 3059) (AD-A058115; AFRPL-TR-78-46-Vol-121) Avail: NTIS HC A10/MF A01 CSCL 11/2

A series of instrumented engineering tests with a chemical vapor deposition furnace used to prepare pyrographite/silicon carbide codeposited material for rocket nozzle applications is described. Flow into the furnace is an axisymmetric confined jet with high Reynolds and low Mach number. The gas flow within the furnace is characterized by a large separated flow region with associated hot spot and a high level of turbulence. Methods of instrumenting and collecting data, methods for defining the furnace and process characteristics, test procedures, recording and reducing data, data analysis, and model development are documented. Analytical models of the furnace during transient and steady state operation were developed and the results compared with the data obtained. Characterization of the coatings obtained and the associated deposition kinetics are also presented. Author (GRA)

N79-11117# Los Alamos Scientific Lab., N. Mex.
DEVELOPMENT OF PYROLYTIC GRAPHITE/SILICON CARBIDE COMPOSITE MATERIALS FOR ROCKET-NOZZLE APPLICATIONS. VOLUME 3: COMPARISON OF DEPOSITION FURNACES AND A GENERIC PROCESS CONTROL SYSTEM SPECIFICATION Final Report, 1 Jul. 1975 - 31 Dec. 1976
G. E. Cort, J. J. Damran, and T. C. Wallace Jul. 1978 32 p refs 3 Vol.
(Contracts F04611-76-X-003; W-7405-eng-36; AF Proj. 3059) (AD-A057982; AFRPL-TR-78-46-Vol-3) Avail: NTIS HC A03/MF A01 CSCL 11/2

This is the final volume in a three volume set describing the pyrolytic graphite/silicon carbide (PG/SiC) coating development work at the Los Alamos Scientific Laboratory (LASL). In this volume the injector deposition furnace was compared with the channel flow furnace that was developed at LASL during this program. They were compared for ease of scaling to larger sizes and modeling with existing computer programs, and relative ease of implementing changes. A specification was given for a generic process control system for the PG/SiC deposition. A recommended step-by-step procedure to develop a coating furnace for a specified rocket-nozzle part was outlined and an example of its use was given. Author (GRA)

N79-11118# Los Alamos Scientific Lab., N. Mex.
DEVELOPMENT OF PYROLYTIC GRAPHITE/SILICON CARBIDE COMPOSITE MATERIALS FOR ROCKET-NOZZLE APPLICATIONS. VOLUME 2: THE CHANNEL FLOW DEPOSITION FURNACE Final Report, 1 Jul. 1975 - 31 Dec. 1976
T. C. Wallace, G. E. Cort, J. J. Damran, D. B. Court, and D. E. Hull Jun. 1978 201 p refs 3 Vol.
(Contracts F04611-76-X-003; W-7405-eng-36; AF Proj. 3059) (AD-A057981; AFRPL-TR-78-46-Vol-2) Avail: NTIS HC A10/MF A01 CSCL 11/2

A series of instrumented engineering tests was described in which a 'channel flow' chemical vapor deposition furnace was used to prepare pyrolytic graphite/silicon carbide (PG/SiC) codeposited material for rocket-nozzle applications. The nozzle section and a water cooled center body formed a vertical annular flow passage for the coating gases. The nozzle section was inductively heated and was coated on the i.d. only. Well-mixed process gas entered the flow annulus with uniform velocity, temperature, and species concentrations from a plenum below the heated substrate. The flow could be either laminar or turbulent, but did not contain recirculating regions. An analytical model of the furnace and deposition process was developed to simulate the heat transfer in the solid components and the flow, chemical

kinetics, and heat and mass transport associated with the process gas. Model predictions and test results on temperatures and PG/SiC deposition rates agreed very well. The coating microstructure and inferred quality were characterized by metallography and correlated with the process variables. The report included detailed descriptions of the furnace, instrumentation, and test procedures in addition to plots of all reduced data. Author (GRA)

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N79-11119*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
A STUDY OF VARIOUS SYNTHETIC ROUTES TO PRODUCE A HALOGEN-LABELED TRACTION FLUID
William R. Jones, Jr. and Hans Zimmer Nov. 1978 10 p refs (NASA-TM-79024; E-9821) Avail: NTIS HC A02/MF A01 CSCL 07C

Several synthetic routes were studied for the synthesis of the compound 1, 1, 3-trimethyl-1, 3-dicyclohexyl-2 chloropropane. This halogen-labeled fluid would be of use in the study of high traction lubricants under elastohydrodynamic lubrication conditions using infrared emission spectroscopy. The synthetic routes included: dimerization of alpha-methylstyrene, methanol addition to alpha-methylstyrene, a Wittig reaction, and an organometallic approach. Because of steric hindrance and competing reactions, none of these routes were successful. Author

N79-11120# Monsanto Research Corp., Dayton, Ohio.
CHARACTERIZATION OF THE STRUCTURE AND PROPERTIES OF VARIOUS METALLIC AND NONMETALLIC MATERIALS Final Report, 1 Apr. 1974 - 30 Apr. 1977
A. G. Jackson (Systems Res. Labs., Inc., Dayton, Ohio), Thomas A. Orofino, Russell E. Pence, and Arthur D. Synder Dec. 1977 39 p
(Contract F33615-74-C-5068)
(AD-A057353; MRC-DA-690) Avail: NTIS HC A03/MF A01 CSCL 11/6

The research covered herein was performed to (1) Establish the microstructures and intrinsic properties characteristic of materials with enhanced use performance and the capability of reliably and predictably retaining this performance in aerospace systems applications, and (2) Obtain information about microstructural and property parameters associated with the achievement of improvements in structural strength and stability through the characterization of materials from AFML in-house investigations. The principal techniques employed in this characterization included optical, electron and scanning electron microscopy, X-ray analysis, electron microprobe analysis and numerous physical test methods. Sample preparation, including forming, heat treatment, grinding, polishing and etching, was required and represented a substantial part of the effort. Much of the program was directed toward the study of the structure and properties of titanium and aluminum alloys. Author (GRA)

N79-11121# Dayton Univ. Research Inst., Ohio.
QUICK REACTION EVALUATION OF MATERIALS AND PROCESSES Final Report, 1 Jan. 1976 - 31 Dec. 1977
D. R. Askins and G. J. Petrak Feb. 1978 217 p refs
(Contract F33615-76-C-5034; AF Proj. 7381)
(AD-A057376; UDR-TR-77-66; AFML-TR-78-6) Avail: NTIS HC A10/MF A01 CSCL 11/6

This report summarizes the results of a variety of materials evaluation and related materials engineering studies which were completed under contract with the Materials Support Division of the Air Force Materials Laboratory. The first section describes studies of the mechanical properties of metal alloys and structural components. Included are data on the mechanical properties of aluminum alloy 7475-T7651, complete crack growth rate data on 2124-T851, and the results of tests on a swivel and link assembly from an operational AF system. A discussion of stress corrosion test techniques is also included. In the second section the test programs involving nonmetallic composites, plastics, and adhesives are discussed. The last section of this report deals with the evaluation of elastomeric sealants, O-rings, and related materials. GRA

N79-11122# National Technical Information Service, Springfield, Va.
CARBORANE CHEMISTRY. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Aug. 1978
Diane M. Cavagnaro Sep. 1978 250 p Supersedes NTIS/PS-77/0825; NTIS/PS-76/0715; NTIS/PS-75/597 (NTIS/PS-78/0928/8; NTIS/PS-77/0825; NTIS/PS-76/0715; NTIS/PS-75/597) Avail: NTIS HC $28.00/MF $28.00 CSCL 07C

The bibliography covers the synthesis and chemistry of carboranes. Reactions, structure, spectra, and other chemical properties are included. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N79-11123 North Carolina State Univ. at Raleigh
MECHANICAL AND THERMAL EXPANSION BEHAVIOR OF ANGLE-PLY AND FILAMENT WOUND COMPOSITES Ph.D. Thesis
Chia-Hsing Chiang 1977 153 p
Avail: Univ. Microfilms Order No. 7811562

Experimental characterization of material properties of unidirectional and angle-ply laminates were conducted. Special emphasis was put on testing of the thick Kevlar-Epoxy and Graphite-Epoxy laminates to failure in compression along thickness direction; the fracture mechanism was observed to be adequately interpreted by the free-edge mode effect rather than by laminate failure theory. Mathematical deriviations were derived which make it possible to analytically evaluate the entire set of elastic constants of angle-ply laminates. Finite element method was adopted for a three-dimensional analysis on behavior of the Kevlar-Epoxy and Graphite-Epoxy filament wound tubes subjected to internal pressure or thermal loading or combination thereof. Failure criteria were applied to predict strength of the tube simulation models. Dissert. Abstr.

N79-11124 Florida Univ., Gainesville.
ELECTROKINETIC PROPERTIES OF SILICA, ALUMINA, AND MONTMORILLONITE Ph.D. Thesis
John Milton Horn 1978 169 p
Avail: Univ. Microfilms Order No. 7817442

The surface chemistry of montmorillonite, vitreous silica and alumina is investigated by electrokinetic methods of streaming potential and microelectrophoresis. Also, improved analytical techniques are developed to obtain these electrokinetic data and adsorption information for these oxide materials. Dissert. Abstr.

N79-11125 Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE TIME-TEMPERATURE BEHAVIOR OF GRAPHITE EPOXY LAMINATES Ph.D. Thesis
Yew Thye Yeow 1978 153 p
Avail: Univ. Microfilms Order No. 7818563

The feasibility of using the time-temperature analogy as an accelerated characterization method to predict the long-term behavior of epoxy based continuous and elastic fiber reinforced composites was investigated. At elevated temperatures, master curves of matrix dominated unidirectional laminates are obtained using the time-temperature superposition principle. Master curves of other off-axis laminates reduced at any arbitrary ambient temperature are then predicted. The unnotched and notched behavior at room temperature is summarized. In the unnotched case, total stress-strain responses of general symmetric laminates are predicted with a nonlinear analysis and compared with experimental results. In the notched case, test results for specimens containing variations in notch geometries and anisotropy are given and correlated to three two-parameter and one one-parameter analytical fracture models. Dissert. Abstr.

N79-11126*# United Technologies Research Center, East Hartford, Conn.
RESEARCH ON GRAPHITE REINFORCED GLASS MATRIX COMPOSITES Annual Report, Jun. 1977 - May 1978
J. F. Bacon, K. M. Prewo, and E. R. Thompson Jun. 1978 122 p refs
(Contract NAS1-14346)
(NASA-CR-158946; R78-912545-28) Avail: NTIS HC A06/MF A01 CSCL 11D

A composite that can be used at temperatures up to 875 K with mechanical properties equal or superior to graphite fiber reinforced epoxy composites is presented. The composite system consist of graphite fiber, uniaxially or biaxially, reinforced borosilicate glass. The mechanical and thermal properties of such a graphite fiber reinforced glass composite are described, and the system is shown to offer promise as a high performance structural material. Specific properties that were measured were: a modified borosilicate glass uniaxially reinforced by Hercules HMS graphite fiber has a three-point flexural strength of 1030 MPa, a four-point flexural strength of 964 MPa, an elastic modulus of 199 GPa and a failure strain of 0.0052. The preparation and properties of similar composites with Hercules HTS, Celanese DG-102, Thornel 300 and Thornel Pitch graphite fibers are also described. Author

N79-11127# Texas Univ. at Austin. Materials Science Lab.
ANALYTIC METHODS FOR STUDYING THE FIBER/MATRIX INTERFACE
H. L. Marcus and Duane Finello 1978 16 p refs
(Contract N00014-78-C-0094)
(AD-A056049) Avail: NTIS HC A02/MF A01 CSCL 11/4

In order to understand the mechanical behavior of metal matrix-graphite composites, it is necessary that the fiber-matrix interface be well characterized. This is of particular importance for transverse loading of the composite. In this paper some of the more successful techniques that have been used to make some measurements concerning the nature of the interface are described. The tools discussed are scanning electron microscopy (SEM), Auger electron spectroscopy (AES), inert ion sputtering (IIS), secondary ion mass spectroscopy (SIMS), and ion microprobe mass analysis (IMMA). GRA

N79-11128# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
EVALUATION OF THE THREE PARAMETER WEIBULL DISTRIBUTION FUNCTION FOR PREDICTING FRACTURE PROBABILITY IN COMPOSITE MATERIALS M.S. Thesis
Dennis R. Schneider Mar. 1978 136 p refs
(AD-A056510; AFIT/GAE/AA/78M-14) Avail: NTIS HC A07/MF A01 CSCL 11/4

This thesis is an evaluation of the three parameter Weibull distribution function for predicting fracture in a composite material subjected to failure under both uniform and nonuniform stress distributions. The specific forms of the three parameter Weibull equations for these failure modes are derived for a general laminated composite and simplified for the special case of a unidirectional composite. An analysis into a parameter determination methodology which is mathematically reproducible is presented. The resulting expressions and methodology are applied to experimental bending, tension and three-point loading failure data for 0 degree and 90 degree unidirectionally laminated graphite-epoxy specimens. Weibull parameter sets are derived from both the bending and tension experimental data. Each set is then used to evaluate the theory's ability to predict the probability of failure throughout the three failure modes and thereby to establish a single set characteristic of the material. A characteristic set of values capable of predicting failure across the variety of failure modes was not found for this composite material. GRA

N79-11129# Army Materials and Mechanics Research Center, Watertown, Mass.
ENVIRONMENTAL EFFECTS ON THE MECHANICAL PROPERTIES OF GLASS FIBER/EPOXY RESIN COMPOSITES. PART 1: EFFECT OF STATIC IMMERSION IN WATER ON THE TENSILE STRENGTH OF CROSS-PLY LAMINATES Final Report
Byung-Lip Lee, Robert W. Lewis, and Robert E. Sacher Apr. 1978 34 p refs
(DA Proj. 1T1-62105-AH-84)
(AD-A056299; AMMRC-TR-78-18-Pt-1) Avail: NTIS HC A03/MF A01 CSCL 11/2

This report describes studies to determine the effect of water absorption on the tensile strength of 90/0/90 deg laminates. The ultimate strength was found to decrease continuously with increasing amounts of water absorption. Yield stress first increased and then decreased to form a broad maximum. Assuming perfect bonding between the laminae, the change of yield stress could be predicted by overlapping the decrease of interlaminar residual stress (as a prestress) and the change of failure stress of 90 deg lamina. Anisotropic volume expansion of the laminae by water absorption is considered to be responsible for the relaxation of interlaminar residual stress. Author (GRA)

N79-11130# Leeds Univ. (England). Dept. of Ceramics.
THE DEVELOPMENT OF THE MECHANICAL STRENGTH OF REACTION-BONDED SILICON NITRIDE Final Report, 1 Oct. 1975 - 31 Dec. 1976
A. J. Moulson and P. Longland Apr. 1978 199 p refs
(Grant DA-ERO-75-G-078)
(AD-A057559) Avail: NTIS HC A09/MF A01 CSCL 11/2

The report describes research aimed at furthering understanding of the nature and mechanism of development of the bond in RBSN. The project formed a part of an overall programme aimed at securing control of the microstructure of RBSN and, in consequence, over the mechanical properties of the ceramic. The study embraced three grades of starting silicon powder: a specially prepared high purity powder (99.99% Si), a similar powder contaminated with Fe (approx. 10 ppm Fe), and a commercial powder (approx. 98% Si; 0.5% Fe; 1.5% AL). Sonic Young's modulus was determined at stages throughout the nitriding reaction for all three powders and the data correlated with microstructural observations. In the case of the high-purity silicon powder it was concluded that the bond forms as a result of the deposition of massive, vapour-formed, Si3N4, and that Si3N4 'whisker' formation played no part in the bonding process. It was also observed that RBSN made from the two higher purity powders had Young's modulus values significantly higher than commonly encountered. A 3-phase composite model developed by Cohen and Ishai satisfactorily described the rate of development of Young's modulus with extent of reaction. Author (GRA)

N79-11131# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
DEVELOPMENT OF INTERCALATED GRAPHITE MATERIALS Final Technical Report, 1 Aug. 1976 - 30 Sep. 1977
Lawrence R. Hanlon Apr. 1978 79 p refs
(Contract F33615-75-C-5231)
(AD-A057503; AFML-TR-78-30) Avail: NTIS HC A05/MF A01 CSCL 11/4

Graphite intercalation compounds were prepared from high-oriented pyrolytic graphite and AsF5 by direct vapor phase synthesis. These compounds were characterized by x-ray and gravimetric analysis and by measurement of the c-axis thickness increase. The c-axis thickness increase proved to be a reliable indicator of stage for stages 1-3; the stochiometry of those stages was found to be C8nAsF5, where n = stage. Room temperature measurements of the optical reflectance were performed from .07-2.0 eV. The compounds showed metallic behavior; the IR reflectance was high and analysis of the plasma edge suggested a high electrical conductivity. This was confirmed by r.f. (100 kHz) eddy-current loss measurements which showed the basal-plane conductivity as high as that of silver. Stability of the stage 3 compounds in air is very good; one sample has shown essentially no change in conductivity after 7100 hours in air. Preliminary work with intercalation of graphite fibers is also reported here; the results of that work are also promising. Author (GRA)

N79-11132# Sandia Labs., Albuquerque, N. Mex.
COMPOS: A COMPUTER PROGRAM FOR THE PROPERTY SYNTHESIS AND HYGROTHERMAL STRESS ANALYSIS OF LAMINATED COMPOSITES
A. M. Lindrose Mar. 1978 96 p
(Contract EY-76-C-04-0789)

(SAND-78-0177) Avail: NTIS HC A05/MF A0

A FORTRAN computer program based on the mathematics and assumptions of classical laminated plate theory synthesizes laminate properties by using individual lamina properties that are either read into the program as data or generated within a separate subroutine. Laminate parameters, such as elastic moduli, coefficients of thermal expansion, moisture swelling, etc., are given in the output. The matrices which govern the coupling of mid-surface strains and curvatures to in-plane force and moment resultants are calculated and printed. The program gives the stress-strain state in the laminate resulting from applied loads and through-the-thickness temperature and moisture concentration profiles. Maximum stress, maximum strain, and Tsai-Hill failure criteria are applied to assess the likelihood of failure in each lamina under specified applied loads and temperature and moisture concentration profiles. DOE

N79-11133# Sandia Labs., Albuquerque, N. Mex.
ROOM TEMPERATURE MOISTURE KINETICS OF KEVLAR 49 FABRIC/EPOXY LAMINATES
R. E. Allred and A. M. Lindrose Sep. 1978 20 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0412) Avail: NTIS HC A02/MF A01

Moisture diffusion coefficients are determined for quasi-isotropic Kevlar 49 181-style fabric reinforced Narmco 5208 epoxy laminates, and for the epoxy and fabric components individually. A microbalance technique is employed to continuously monitor the percentage weight gain of specimens exposed to 76 percent relative humidity at room temperature. The anisotropy of moisture diffusivity in the composite laminates is determined by use of a slope ratio (absorption vs time) technique and specimens of appropriate geometry. Results show that moisture diffuses in the laminate plane two orders of magnitude faster than through the thickness. These values compare to a resin diffusivity of 6.5x 10 to the -10th power sqcm/sec. It is speculated that the rapid inplane diffusion is due to the preferential diffusion of moisture in the filament along its length. DOE

N79-11134# California Univ., Berkeley. Lawrence Berkeley Lab. Materials and Molecular Research Div.
PORE STRUCTURE AND GROWTH KINETICS IN CARBON MATERIALS Ph.D. Thesis
Sudhangshu Bose Apr. 1978 86 p refs
(Contract W-7405-eng-48)
(LBL-7638) Avail: NTIS HC A05/MF A01

Pore structure of glassy carbon (GC) and pyrolytic graphite (PG) was investigated. One third of the microstructure of GC consists of closed pores inaccessible to fluids. The microstructure of this material was characterized using X-ray diffraction and high resolution electron microscopy. Small angle X-ray scattering was used to measure the angstrom sized pores and to follow the evolution of pore surface area as a function of heat treatment temperature and heat treatment time at constant temperature. From these measurements an analysis of the surface area kinetics was made to find out if rate processes are involved and to locate graphitization occurring at pore surfaces. The PG on the other hand was found to have larger sized pores that comprise five percent of its volume. In addition to being closed these pores are oriented. Some pore models are proposed for PG and the existing scattering theory from oriented ellipsoids is modified to include the proposed shapes. DOE

N79-11135# European Space Agency, Paris (France).
INVESTIGATION OF PHASE EQUILIBRIA OF TaC-FIBRE REINFORCED COBALT ALLOYS HAVING DIRECTIONALLY SOLIDIFIED EUTECTIC STRUCTURE AIMED AT MATRIX HARDENING
Adolf Donner Sep. 1978 101 p refs Transl. into ENGLISH of 'Untersuch. der Phasengleichgewichte von TaC-faserverstaerkten Kobalt-Legierungen mit gerichtet erstarrtem eutektischem Gefuege im Hinblick auf Haertungsmoeglichkeiten der Matrix', DFVLR, Cologne Report DLR-FB-77-58, 3 Jan. 1978 Original report in GERMAN previously announced as N78-31939 Original German report available from DFVLR, Cologne DM 35,80
(ESA-TT-513; DLR-FB-77-58) Avail: NTIS HC A06/MF A01

The possiblity of improving the 900 C creep strength of directionally solidified two phase eutectic alloys by precipitation of a third phase which is stable at high temperatures was investigated. It was found that: (1) the aluminum content necessary for the precipitation of aluminum nitride has an insignificant effect on the eutectic equilibrium of (Co, Cr, Ni)-TaC. This allows the precipitation of aluminum nitride particles subsequent to directional solidification; (2) by varying the composition in the system (Co, Cr, Ni)-TaC as well as precipitation of M6C carbides by the addition of tungsten, niobium, and molybdenum, the precipitation of Co2Ta results in such significant changes in the eutectic equilibrium that the directional solidification is prevented. Author (ESA)

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N79-11136 Rice Univ., Houston, Tex.
STUDIES IN LASER SPECTROSCOPY: LASER DOUBLE RESONANCE AND LASER EXCITATION OF CESIUM DURING COLLISION WITH RARE GAS ATOMS Ph.D. Thesis
Tzu-Min Robert Su 1978 114 p
Avail: Univ. Microfilms Order No. 7814807

The use of lasers in double resonance studies is reported. Initially, an optical-resolution inside the Doppler width was developed. In the method one of optical frequencies is generated as a modulation sideband. Using a Pockels cell modulator, the experiment was demonstrated on the ground state Zeeman levels of the Na atom. Finally, a theoretical treatment of the microwave optical double resonance experiment including the effects of spatial degeneracy and the polarization of the radiation field was developed and used to analyze a double resonance experiment in which circularly polarized microwaves cause a light field which is initially linearly polarized to become elliptically polarized along a slightly different axis. Dissert. Abstr.

N79-11137 State Univ. of New York at Buffalo, Amherst.
CHROMATOGRAPHIC BEHAVIOUR AND EVALUATION OF THE PROPERTIES OF LIQUID CRYSTALS USED AS STATIONARY PHASES IN GAS CHROMATOGRAPHY Ph.D. Thesis
Joseph Fay Solsky 1978 197 p
Avail: Univ. Microfilms Order No. 7817080

Liquid crystals are increasingly being used as stationary phases in gas chromatography in both normal packed columns and capillary columns. This can be attributed to their highly selective properties when used in their mesomorphic or liquid crystalline ranges. Two such compounds were employed; 4, 4' -dimethoxyazoxybenzene (PAA) and p-(pethoxyphenylazo) phenylundecylenate (EPAPU). The chromatographic properties such as retention, efficiency, and mass transfer (including various thermodynamic properties) were studied using liquid crystals coated on two types of glass beads and Chromosorb W using various concentrations of the liquid crystals. Dissert. Abstr.

N79-11138 Cornell Univ., Ithaca, N. Y.
A STUDY OF STIMULATED INFRARED SCATTERING IN n-InSb WITH APPLICATIONS TO INFRARED SPECTROSCOPY Ph.D. Thesis
Niloy Kumar Dutta 1978 183 p
Avail: Univ. Microfilms Order No. 7817780

A study of stimulated scattering of radiation in InSb in the 5-6 microns region and its application to gas molecular spectroscopy is presented. Stimulated spin flip Raman scatter-ing(SFR) was observed in InSb using a CW 5 microns CO laser as a pump source. Tuning characteristics and magnetic field dependence of the output were studied. The radiation has a line width of less than 0.01/cm and tunes to lower frequency at a rate of 2.1/cm/KG. The CW spin flip Raman laser(SFRL) was used for gas phase molecular spectroscopy over the range 1880-1820/cm.

the molecules investigated include NO, OCS, DBR and C2H4. The techniques employed were direct absorption measurements, optoacoustic detection and intracavity absorption. The feasibility of intracavity spectroscopy was demonstrated with external cavity CW SFRL. Significantly enhanced sensitivity was observed under marginal oscillator conditions. Dissert. Abstr.

N79-11139 Cornell Univ., Ithaca, N. Y.
THERMAL RUNWAY Ph.D. Thesis
Reuben Olafenwa Ayeni 1978 81 p
Avail: Univ. Microfilms Order No. 7817820

Mathematical questions concerning the one-dimensional mixing and simultaneous reaction of a fuel and oxidant were studied. Of particular interest was the so-called ignition time, before which temporal changes in temperature were negligible; estimates were given for it as a function of activation energy which can vary over all positive values. It was shown that thermal runaway, i.e., blow up of the temperature, occurred at a finite time in the limit of infinite activation and a lower bound was derived for that time by means of a comparison theorem. Bounds on the temperature were also given for finite activation energy, from which the blow up can be traced as the latter tends to infinity. A full qualitative analysis of the preignition period was made. At various stages generalizations of the problem were considered, in particular to more than one dimension. Existence and uniqueness results figured prominently. Dissert. Abstr.

N79-11140 Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE DESIGN AND CONSTRUCTION OF A MULTIWAVELENGTH UV-VIS DETECTOR SYSTEM FOR LIQUID CHROMATOGRAPHY Ph.D. Thesis
Wayne Gilbert Nunn 1978 670 p
Avail: Univ. Microfilms Order No. 7819114

Holographically ruled concave gratings were used to optimize the performance of linear photodiode arrays in a dual beam multi-wavelength detector system whose outputs are analyzed by a front-end processor which does an analog subtraction of the reference from the sample signal and converts the resulting transmittance to absorbance. The computer acquires data by either single spectrum or ensemble averaging, stores the spectral information, and provides a software set that allows the examination and plotting of the spectral data as either UV-VIS spectra or chromatograms at a specific wavelength. Performance tests of the detector show that detectors of this type would have significant value in to the field of analytical chemistry if the detection limits were lower by one or two orders of magnitude (the current detection limit is 15 mg of acetone at 269 nm with an extinction coefficient of 15). Dissert. Abstr.

N79-11141 Wyoming Univ., Laramie.
SYNTHESIS AND PRELIMINARY EVALUATION OF SOME EDTA-TYPE CHELATING AGENTS FOR USE IN TRACE METAL ANALYSIS BY LIQUID CHROMATOGRAPHY Ph.D. Thesis
James Reid Beckett 1978 128 p
Avail: Univ. Microfilms Order No. 7818928

In order to evaluate the potential of liquid chromatography for trace metal analyses the lead, cadmium, chromium zinc, and iron chelates of phenylEDTA (I), the lead, cadmium, chromium, and iron chelates of 4-nitro phenylEDTA (II) and the lead, cadmium, and zinc chelates of 4-amino phenylEDTA (III) were synthesized. The metal chelates were characterized by normal analytical techniques. The ultraviolet spectra were recorded for all chelates as were the fluorescence spectra of the 4-amino chelates following reaction with Fluorescamine. All chelates could be separated by liquid chromatography using either reverse-phase or ion exchange modes of separation. The phenyl and r-nitro phenyl chelates were detected using ultraviolet spectroscopy and exhibited sensitivities in the nano- or subnanogram range for the indicated metals. The r-amino chelates were detected by fluorescence spectroscopy following post-column derivatization with Fluorescamine. Dissert. Abstr.

N79-11142 Vanderbilt Univ., Nashville, Tenn.
NUMERICAL CONSIDERATIONS OF SATURATION TRANSFER ELECTRON PARAMAGNETIC RESONANCE AND ELECTRON-ELECTRON DOUBLE RESONANCE Ph.D. Thesis
Norval B. Galloway, III 1978 139 p
Avail: Univ. Microfilms Order No. 7819528

Models suitable for examining the influence of applied modulation fields in the fast motion regime are discussed. The theory developed incorporates modulation explicity and is found to relate to the derivative approximation through a power series expansion in which the modulation frequency is the expansion parameter. The approximations are found to work uniformly well under ST-EPR conditions for the conventional EPR and inphase-quadrature dispersion signals. Several experimental configurations are considered over ranges of modulation and relaxation parameters for both homogeneous and inhomogeneous line spectra. Relaxation parameters are accurately determined using expressions derived from the derivative theory. Dissert. Abstr.

N79-11143 Oklahoma Univ., Norman.
COMBUSTION WAVES ASSOCIATED WITH WEAK DISTURBANCES Ph.D. Thesis
Jin-Shou Hamilton Hseu 1977 98 p
Avail: Univ. Microfilms Order No. 7817885

A theoretical investigation was focused on the combined effects of gas dynamics, viscosity, heat conduction, mass diffusion, and chemical reactions on the wave propagation induced by weak disturbances. The governing equations for multicomponent reacting gas mixtures were set up within the framework of a general linearized theory. The combustion process was approximated by a simple one-step reaction, involving a ternary mixture of oxidant, fuel, and product. The pertinent governing partial differential equation for the velocity potential was derived and applied to several specific physical problems. Laplace transform techniques were utilized to obtain asymptotic longtime wave behavior. It was shown that Burgers' equation was the appropriate description of the equilibrium wave propagation. A general expression for the laminar flame speed which displays the dependency on the reaction order, heat of combustion, characteristic reaction time, and the transport properties of the system was obtained. Dissert. Abstr.

N79-11144 Florida Univ., Gainesville.
THE OPTIMIZATION OF ENERGY RECOVERY SYSTEMS Ph.D. Thesis
Jigar V. Shah 1978 129 p
Avail: Univ. Microfilms Order No. 7817457

The program EROS (energy recovery optimization system) is a flowsheeting package for evaluating and optimizing the performance of simple networks of heat exchangers. Using EROS, an arbitrary structure of heat exchangers, stream splitters and mixers was set up. Stream flow rates and entry and exit temperatures may be specified, free, or bounded above and/or below. Phase changes may be allowed to occur. Requiring no more user input, the program gathers together the modeling equations and appropriate inequality constraints. It then develops solution procedures repeatedly in the course of optimizing, initially to aid in locating a feasible point (which need not be specified by the user) and in the final stages to take advantage of tight inequality constraints to reduce the degree of freedom. The program is written in standard FORTRAN and is currently operable on IBM 360/67. Dissert. Abstr.

N79-11145 State Univ. of New York at Stony Brook.
ANALYTICAL APPROACH TO THE STATISTICAL THEORY OF SIMPLE LIQUIDS AND IONIC SOLUTIONS Ph.D. Thesis
Sai-Fung Sun 1978 177 p
Avail: Univ. Microfilms Order No. 7817564

For simple liquids, particles interacting via a Lennard-Jones type potential as well as a hard-core-plus-two-Yukawa potential are considered. For ionic solutions, the binary mixture of the restricted primitive model was used. Over the past decade it has become clear that the mean spherical approximation (MSA) was reasonably accurate for both simple liquids (uncharged hard spheres) and ionic solutions (charged hard spheres). Various approximations that go beyond the MSA were investigated. A generalized mean spherical approximation for ionic system and an ordering scheme for both simple liquids and ionic systems was considered. These approximations were largely analytic in nature; that is, many of our results were reducible to closed-form

expressions, or to simple one dimensional integrals.
Dissert. Abstr.

N79-11146 Wyoming Univ., Laramie.
DIELECTRIC CONSTANTS, EXCESS VOLUMES AND COMPRESSIBILITIES FOR LIQUID MIXTURES OF NITROGEN, ARGON, METHANE AND ETHANE, FROM 91 TO 115 K AT PRESSURES TO 50 MPa Ph.D. Thesis
Surendra Paul Singh 1978 207 p
Avail: Univ. Microfilms Order No. 7818945

It was demonstrated that relatively simple dielectric constant measurements can be used as substitutes for more difficult volumetric measurements for mixtures of simple liquids. The method involved measurement of pure component and mixture dielectric constants, which were combined with previously published pure-component molar volumes. Excess volumes were derived on the assumption of zero Clausius-Mossotti function change on mixing. Binary mixtures of N2, Ar, CH4 and C2H6 were studied at selected compositions, covering as much of the composition range as practical. Only the equimolar and methane rich compostions were studied for the ternary mixtures. The isothermal measurements were made at 91, 100, 108 and 115 K to 50 MPa (or to the lowest of the freezing pressures of the components). Dissert. Abstr.

N79-11147 Princeton Univ., N. J.
THE EFFECTS OF HYDRODYNAMICS AND COLLOIDAL FORCES ON THE COAGULATION OF DISPERSIONS Ph.D. Thesis
Glenn Robert Zeichner 1978 228 p
Avail: Univ. Microfilms Order No. 7818365

The coagulation of colloidal dispersions in flow fields was investigated. A hydrodynamic trajectory analysis was used to predict colloidal stability under various conditions of flow and to extract information about colloidal forces from experimental data. Shear-induced coagulation experiments were carried out in Couette flow with aqueous dispersions of monodisperse polystyrene particles. The particles were made by a surfactant-free process and had a diameter of 500 nm. A low angle light scattering technique previously developed for Brownian coagulation studies was adapted for the measurement of shear-induced coagulation rates. Trajectories were computed for two equal-sized spherical particles in simple laminar shearing and in uniaxial extensional flows. Effects of interparticle attraction, electrostatic repulsion and hydrodynamics were included. Dissert Abstr.

N79-11148 Cornell Univ., Ithaca, N. Y.
EXPERIMENTAL INVESTIGATION OF FLOW TURBULENCE EFFECTS ON PREMIXED METHANE AIR FLAMES Ph.D. Thesis
Kenneth Owen Smith 1978 234 p
Avail: Univ. Microfilms Order No. 7817843

An experimental investigation of flow turbulence effects on premixed, methane-air flames was conducted to accurately document the role of turbulence macroscale and root mean square (rms) velocity fluctuation in altering flame structure and flame speed. Measurements of time mean turbulent flame speeds and mean and rms fluctuating flame temperature profiles were taken. Flame thickness information was deduced from mean temperature data. This study indicates that the employed measurement technique can provide accurate flame speed data. The importance of local measurements is underscored. In particular, flow direction changes attributable to combustion can significantly influence flame speed measurement accuracy. Dissert. Abstr.

N79-11149 Yale Univ., New Haven, Conn.
HIGH RESOLUTION SPECTROSCOPY OF He2 AND H2 UTILIZING A MOLECULAR BEAM MAGNETIC RESONANCE TECHNIQUE AND A MOLECULAR BEAM DYE LASER TECHNIQUE Ph.D. Thesis
Thomas Robert Wik 1977 290 p
Avail: Univ. Microfilms Order No. 7818686

The molecular beam magnetic resonance technique was used to extend the measurements of the fine structure of diatomic helium and hydrogen molecules to additional rotational and vibrational levels. A new method of Doppler-free laser spectroscopy was developed which is applicable to atoms and molecules having metastable states. This method was applied to the measurement of the Ne-20-22 isotope shift in three transitions. Dissert. Abstr.

N79-11150 Wyoming Univ., Laramie.
KINETIC MODELING OF PYROLYSIS AND HYDROGASIFICATION OF CARBONACEOUS MATERIALS Ph.D. Thesis
Dung Quoc Tran 1978 309 p
Avail: Univ. Microfilms Order No. 7818947

A thermogravimetric analyzer was used to determine kinetic parameters of catalyzed and noncatalyzed samples of various wood wastes. Catalyzed samples were prepared by impregnating 20 wt% of potassium carbonate on the sample particles. A one inch diameter fixed bed flow reactor was used to investigate the effect of various operating variables such as temperature, steam rate, catalyst, and particle size of the sample on pyrolysis and gasification. For the pyrolysis step, the apparent activation energy is found to be a linear function of conversion. However, for the hydrogasification step, the apparent activation energy varies as a second degree polynomial with respect to conversion. A proposed pyrolysis model is used to predict conversion as a function of time. The prediction shows good agreement with fluidized bed data obtained by other investigators.
Dissert. Abstr.

N79-11151* National Aeronautics and Space Administration. Pasadena Office, Calif.
COMBUSTER Patent
Richard A. McKay, inventor (to NASA) (JPL) Issued 1 Aug. 1978 7 p Filed 26 Nov. 1976 Sponsored by NASA
(NASA-Case-NPO-13958-1; US-Patent-4,104,018;
US-Patent-Appl-SN-745384; US-Patent-Class-432-29;
US-Patent-Class-126-91A; US-Patent-Class-431-10;
US-Patent-Class-431-208; US-Patent-Class-432-223) Avail: US Patent Office CSCL 21B

A combuster is provided for utilizing a combustible mixture containing fuel and air, to heat a load fluid such as water or air, in a manner that minimizes the formation of nitrogen oxide. The combustible mixture passes through a small diameter tube where the mixture is heated to its combustion temperature, while the load fluid flows past the outside of the tube to receive heat. The tube is of a diameter small enough that the combustible mixture cannot form a flame, and yet is not subject to wall quench, so that combustion occurs, but at a temperature less than under free flame conditions. Most of the heat required for heating the combustible mixture to its combustion temperature, is obtained from heat flow through the walls of the pipe to the mixture. Official Gazette of the U.S. Patent Office

N79-11152* National Aeronautics and Space Administration. Pasadena Office, Calif.
SURFACTANT-ASSISTED LIQUEFACTION OF PARTICULATE CARBONACEOUS SUBSTANCES Patent
George C. Hsu, inventor (to NASA) (JPL) Issued 24 Oct. 1978 8 p Filed 7 Oct. 1976 Supersedes N78-25237 (16 - 16, p 2097) Sponsored by NASA
(NASA-Case-NPO-13904-1; US-Patent-4,121,995;
US-Patent-Appl-SN-730468; US-Patent-Class-208-8;
US-Patent-Class-208-10; US-Patent-Class-44-51;
US-Patent-Class-302-66) Avail: US Patent Office CSCL 07D

A slurry of carbonaceous particles such as coal containing an oil soluble polar substituted oleophilic surfactant, suitably an amine substituted long chain hydrocarbon, is liquefied at high temperature and high hydrogen presence. The pressure of surfactant results in an increase in yield and the conversion product contains a higher proportion of light and heavy oils and less asphaltene than products from other liquefaction processes.
Official Gazette of the U.S. Patent Office

N79-11153*# Kentucky Univ., Lexington. Coll. of Engineering.
AN EXPERIMENTAL STUDY OF THE INFLUENCE OF ELEVATED BUOYANCY LEVELS ON FLAME SPREAD RATE OVER THERMALLY THIN CELLULOSIC MATERIALS
P. C. Shang, R. A. Altenkirch, and R. Eichhorn Nov. 1978 65 p refs
(Grant NsG-3114)
(UKY-TR109-78-ME17) Avail: NTIS HC A04/MF A01 CSCL 21B

The role of buoyancy on the flame spread rate over paper and its effect on extinction was studied by changing the gravity level and pressure. It was found that the flame spread rate decreases as the buoyancy induced flow increases. A method for correlating flame spread data using dimensionless parameters is presented. The Damkohler number is shown to be the dependent variable. F.O.S.

N79-11154*# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
ISOTOPIC ANOMALIES FROM NEUTRON REACTIONS DURING EXPLOSIVE CARBON BURNING
Typhoon Lee (Chicago Univ.), D. N. Schramm (Chicago Univ.), J. P. Wefel (Chicago Univ.), and J. B. Blake 31 Oct. 1978 27 p refs
(Grant NsG-7212)
(NASA-CR-157924; ATR-79(9552)-1) Avail: NTIS HC A02/MF A01 CSCL 21B

The possibility that the newly discovered correlated isotopic anomalies for heavy elements in the Allende meteorite were synthesized in the secondary neutron capture episode during the explosive carbon burning, the possible source of the O-16 and Al-26 anomalies, is examined. Explosive carbon burning calculations under typical conditions were first performed to generate time profiles of temperature, density, and free particle concentrations. These quantities were inputted into a general neutron capture code which calculates the resulting isotopic pattern from exposing the preexisting heavy seed nuclei to these free particles during the explosive carbon burning conditions. The interpretation avoids the problem of the Sr isotopic data and may resolve the conflict between the time scales inferred from 1-129, Pu-244, and Al-26. Author

N79-11155# Indiana Univ. at Bloomington. Dept. of Chemistry.
CORRELATION ON METHODS IN CHEMICAL DATA MEASUREMENT
Gary Horlick and Gary M. Hieftje Mar. 1978 146 p refs
(Contract N00014-77-C-0444)
(AD-A057391) Avail: NTIS HC A07/MF A01 CSCL 07/4

A review was presented covering applications of correlation analysis to signal processing, kinetic measurements, signal-to-noise enhancement, and optical heterodyne measurements. Past work in these areas and predicted future developments are outlined. Author (GRA)

N79-11156# SRI International Corp., Menlo Park, Calif.
THE ABSOLUTE MEASUREMENT OF RATE CONSTANTS FOR SOME KEY REACTIONS INVOLVING FREE RADICALS Final Report, 1 Jan. 1975 - 28 Feb. 1978
David M. Golden, Michel Rossi, Gregory P. Smith, Karan E. Lewis, and Sidney W. Benson Apr. 1978 157 p refs
(Contract F44620-75-C-0067)
(AD-A056022; AFOSR-78-068TR) Avail: NTIS HC A08/MF A01 CSCL 07/4

Progress has been made in several areas of experimental and theoretical importance to the understanding of rate parameters in reactions important to combustion. We combined simple physical models with experiments devised to test these models with the objective of increasing our ability to estimate rate constants with an accuracy useful at a chemical level. GRA

N79-11157# Army Armament Research and Development Command, Watervliet, N. Y. Benet Weapons Lab.
ENERGY AND PRESSURE CALCULATIONS FOR METALLIC NH4
D. M. Gray Dec. 1977 73 p refs
(AD-A056017; AD-E440006; ARLCB-TR-77048) Avail: NTIS HC A04/MF A01 CSCL 07/4

It has long been known that the ammonium ion NH4(-) behaves in many ways like an alkali metal ion. This report discusses a possible transition (under pressure) from a mixture of ammonia and hydrogen (NH3-1/2H2) to metallic NH4 in the 'funny sodium' form. This form may be defined as a lattice composed of metallic NH4(-) ions and s-like electrons (one per ion). The ion has the sodium Z number but only seven protons (those from N) are in the nucleus; the other four protons (those from the four H atoms) from a tetrahedral arrangement around the N nucleus. This tetrahedral arrangement is then approximated by a spherical shell at a radius determined by a variational calculation for the total energy of the tetrahedral ion. (The resulting radius lies well out in the ion electron cloud.) Since a Wigner-Seitz polyhedra approach is used, no specific lattice structure is considered. The earlier calculation of Bernal and Massey (BM) and the more recent calculation of Stevenson is discussed. Emphasis is on the BM metallic calculation which we have essentially repeated. GRA

N79-11158# AeroChem Research Labs., Inc., Princeton, N. J.
IONIC MECHANISMS OF CARBON FORMATION IN FLAMES Annual Report, 1 Jan. - 31 Dec. 1977
Hartwell F. Calcote and William J. Miller May 1978 35 p refs
(Contract F49620-77-C-0029)
(AD-A056023; AeroChem-TP-371; AFOSR-78-1082TR) Avail: NTIS HC A03/MF A01 CSCL 21/2

Premixed laboratory test flames of a number of hydrocarbons have been examined to determine the effects of pressure and fuel structure on the critical fuel are mixture ratio for soot onset. The tendency for flames to soot increases, in general, with the aromaticity and molecular weight of the fuel; pressure has little effect. Mass spectrometric probing of nearly sooting acetylene/air and benzene/air flames reveals a wide variety of naturally occurring high molecular weight hydrocarbon ions. As the equivalence ratio at which soot appears is approached, the average molecular weight of these flame ions increases. Both fuels give rise to very similar ionic species in the mass range above about 150 amu. These ions are separated by 12 or 13 amu and correlate with the molecular weights of stable polycyclic aromatic species or free radicals. Distinct differences appear in the charged species distributions of benzene and acetylene flames in the mass range below about 150 amu, i.e., in the nucleation and early polymerization processes. The reactions subsequent to this early reaction mechanism apparently lead to aromatic species which are essentially independent of the identity of the fuel and which can grow rapidly to a complex array of polycyclic aromatics and soot. GRA

N79-11159# Monsanto Research Corp., Dayton, Ohio.
AN ULTRAVIOLET PHOTOMETRIC DETECTOR FOR USE IN GAS CHROMATOGRAPHY Interim Technical Report, 1 Feb. 1976 - 31 Mar. 1977
F. Neil Hodgson, H. C. Tucker, and Ronald D. Butler Nov. 1977 33 p refs
(Contract F33615-76-C-2014)
(AD-A056257; AFAPL-TR-77-60) Avail: NTIS HC A03/MF A01 CSCL 21/4

An ultraviolet photometric detector, which responds only to aromatic constituents in the vapor state, has been designed and constructed for use in gas chromatography. Tine unit exhibits appreciably greater sensitivity than the normal conductivity detector. It was tested by chromatographing a variety of fuels including JP-4, JP-8, JET-A, and regular gasoline. Tests indicate that the unit provides a viable means of determining the aromatic composition of fuels. Author (GRA)

N79-11160# Harry Diamond Labs., Adelphi, Md.
INFRARED DIAGNOSTICS FOR NEAR-MILLIMETER WAVE SOURCES
Joseph P. Sattler, Terrance L. Worchesky, Kenneth J. Ritter, George J. Simonis, and Walter A. Riessler Jun. 1978 14 p refs Sponsored by the US Army Electronic Research and Development Command
(AD-A056484) Avail: NTIS HC A02/MF A01 CSCL 07/4

New IR heterodyne and Stark spectroscopic techniques have been developed and applied to the analysis of molecular Near Millimeter Wave (NMMW) sources. These procedures have revealed previously unresolved molecular IR structure. Quantum number assignments and absolute frequencies of transitions have been tabulated for CH3F, D2O, and CH3OH. New NMMW operating frequencies have been predicted. The results have implications for both fundamental and applied research, since our measurements provide new information regarding molecular structure, as well as important parameters for NMMW source modeling. GRA

N79-11161# Syracuse Univ., N. Y. Dept. of Chemistry.
PHOTOCHEMICAL DISSOCIATION FROM SELECTED ROVIBRONIC STATES IN POLYATOMIC MOLECULES Final Report, 1 Apr. 1975 - 31 Mar. 1978
George H. Atkinson 6 Jul. 1978 11 p refs
(Grant DAAG29-75-G-0104)
(AD-A057358; ARO-12610.5-C) Avail: NTIS HC A02/MF A01 CSCL 20/8

This report summarizes the results of a study which was intended to provide a clearer understanding of the relationships between the pathways for photodissociation of gas phase, polyatomic molecules and the quantum states into which they are initially excited. The study characterized these relationships by examining the absolute and relative efficiencies for dissociation along specific pathways leading to particular products. The parent molecule was, in general, prepared by excitation in single vibronic levels (SVL) in which a broad, undefined distribution of rotational levels was simultaneously populated. Author (GRA)

N79-11162# United Technologies Research Center, East Hartford, Conn.
MASS SPECTROMETER STUDY OF NO FORMATION IN METHANE-AIR FLAMES
D. J. Seery and M. F. Zabielski 1977 14 p refs Presented at Fall Meeting of the Western States Sec. of the Combustion Inst., Palo Alto, Calif., 17 Oct. 1977
(CONF-771015-22) Avail: NTIS HC A02/MF A01

The mechanism of NO formation in flames was studied with special emphasis on possible perturbation of the gas sample by reactions in the probe. Temperature profiles were obtained using miniature thermocouples and gas samples were taken from the flame using both a molecular beam sampler and quartz microprobes. Molecular beam sampling was selected as the standard for comparison with the microprobe. The data show a dramatic decrease of the NO concentration profiles in the microprobe samples as compared with the molecular beam samples. The first assumption from the evidence is that reactions in the microprobe are consuming NO. Author (DOE)

N79-11163# Mason and Hanger-Silas Mason Co., Inc., Amarillo, Tex.
HIGH SPEED GEL PERMEATION CHROMATOGRAPHY (3)
E. Kohn May 1978 10 p refs
(MHSMP-78-19) Avail: NTIS HC A02/MF A01

Some calibration procedures and methods for establishing molecular weights and weights and molecular weight distributions of polymers are described. They include adjustments of the calibration curve to changes in the performance of the microstyragel columns, improved data processing techniques, and evaluation of temperature and internal standard concentration effects on the calibration parameters. The results showed that: (1) recalibration of microstyragel columns is frequently required, normally every few months; (2) column temperature control to a tenth of a degree is required to avoid significant calibration errors; and (3) the concentration of some internal standards must be held constant to obtain reproducible results. DOE

N79-11164# California Univ., Berkeley. Dept. of Mechanical Engineering.
INHIBITION EFFECTS ON EXTINCTION OF POLYMER BURNING
W. J. Pitz and R. F. Sawyer Apr. 1978 21 p refs Presented at the Western States Section/Combustion Inst., Boulder, Colo., 17 Apr. 1978
(Contract W-7405-eng-48; Grant NBS-G7-9006)
(LBL-6898; Conf-780417-6) Avail: NTIS HC A02/MF A01

Inhibitors were added to both the gaseous oxidizer and the solid fuel. Extinction data were obtained for polyethylene (PE) and poly(vinyl chloride) (PVC) in N2/O2 mixtures. These data are compared to extinction measurements of polyethylene with an N2/O2/HCl mixture. Poly(vinyl chloride) differs chemically from polyethylene only by a substitution of a chlorine atom for a hydrogen atom in the monomer. With the inclusion of this halogen atom, poly(vinyl chloride) may be thought of as an inhibited polyethylene and therefore well suited for a comparative study. The behavior of the HCl added to the oxidizer side of the diffusion flame was found to be primarily that of an inert, in comparison to Cl being added to the fuel side of PVC. Impurities in this commercial PVC and PE may have had an effect on the extinction data. DOE

N79-11165# California Univ., Davis.
NUMERICAL MODELING OF UNSTEADY FLAME PROPAGATION
H. A. Dwyer and B. R. Sanders (Sandia Labs, Livermore, Calif.) Feb. 1978 31 p refs
(Contract EY-76-C-04-0789)
(SAND-77-8275) Avail: NTIS HC A03/MF A01

The problem of the numerical modeling of unsteady flame propagation with large amounts of exothermic heat release was addressed through the use of a model equation which contains many of the important nonlinearities and difficulties in the problem. The model equation was solved for a significant variation in Damkoehler number with a variety of conventional and new finite-difference procedures. An adaptive grid method is described which places node points in the region of large temperature gradients where they are necessary for a proper simulation of the phenomena. This procedure has significant advantages over conventional second- and fourth-order uniform grid methods for many aspects of the problem. It was found that conventional methods with relatively few node points are inadequate for flames with high Damkoehler number, because of the fact that too few nodes are located in the flame. DOE

N79-11166# Dow Chemical Co., Midland, Mich. Hydrocarbons and Energy Research Lab.
CHEMICALS FROM COAL. REPORT BASED ON HRI H-COAL PRODUCT Final Report
Bruce C. Peters 25 Oct. 1977 32 p
(Contract EX-76-C-01-1534)
(FE-1534-50; DOW-FR-363) Avail: NTIS HC A03/MF A01

The final results of an investigation to determine the suitability of the COED, H-COAL, SYNTHOIL, and SRC II syncrudes as petrochemical feedstocks are reported. Based on the results of laboratory investigations, conversions of the liquid products to petrochemical feedstocks per ton of coal fed to each liquefaction process was 15.0 percent, 33.9 percent, 26.9 percent, and 23.0 percent respectively. While it is recognized that the samples obtained were from liquefaction runs that were not necessarily representative, based on the samples that were furnished, the H-COAL process produces the maximum yield of feedstocks and was chosen as the basis for the preliminary design and economics for a commercial chemical refinery. From a chemical refinery sized to process 50,000 barrels per stream day of H-COAL derived syncrude, yields of 653 anti M lb/year of ethylene and 245 anti M gal/year of benzene were calculated. DOE

N79-11167# Sandia Labs., Albuquerque, N. Mex. Photometrics and Optical Development Div.
TECHNIQUE FOR MEASURING PbS FILM REFLECTIVITY
H. Parke Davis and Murphy J. Landry May 1978 13 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0058) Avail: NTIS HC A02/MF A01

A technique is described to measure the internal reflectivity of modified right-angle prisms. One of the internal reflecting surfaces is altered by a vacuum-vapor-deposited lead sulfide film. The prisms were used in a Nd(3+) glass laser as a cavity Q spoiling device. The removal of this film by ionization produced a self Q-switched laser pulse. All reflectivity measurements were made with a commercial spectrophotometer and specially designed optical mounts. Reflectivities were measured over a wavelength range from 800 to 2000 nm with prime interest at the losing wavelength 1060 nm. Resultant data at 1060 nm shows film reflectivity of the prism's glass-film interface decreasing with increasing evaporation time. Data also shows minimum reflectivity for a specific evaporation time with P oriented linearly polarized light, as compared to S orientation and elliptically polarized light. The optical mounts and measurement technique described provided valid reflectivity information in the self Q-switched laser experiment. DOE

N79-11168# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
NONEQUILIBRIUM PHOTOCHEMICAL REACTIONS INDUCED BY LASERS Technical Progress Report
J. I. Steinfeld Apr. 1978 8 p refs

(Contract EY-76-S-02-2793)
(COO-2793-12) Avail: NTIS HC A02/MF A01

Research in advanced (laser) isotope separation is summarized. These are: (1) infrared double resonance spectroscopy of molecules excited by multiple infrared photon absorption, particularly SF6 and vinyl chloride; (2) infrared multiphoton excitation of metastable triplet-state molecules, e.g., biacetyl; (3) an information theory analysis of multiphoton excitation and collisional deactivation has been carried out; (4) the mechanism of infrared energy deposition and multiphoton-induced reactions in chlorinated ethylene derivatives; and RRKM (statistical) model accounts for all observed behavior of the system, and a deuterium-specific reaction pathway has been identified; (5) diffusion-enhanced laser isotope separation in N(16)O/N(18)O; and (6) a technical evaluation of laser-induced chemistry and isotope separation. DOE

N79-11169# Technical Research Centre of Finland, Espoo. Reactor Lab.
THE RELIABILITY OF RADIOCHEMICAL AND CHEMICAL TRACE ANALYSIS IN ENVIRONMENTAL MATERIALS Ph.D. Thesis - Helsinki University
Jorma Heinonen 1977 102 p refs Sponsored by Maj and Tor Nessling Found.
(VTT-ENT-22; ISBN-951-38-0552-2) Avail: NTIS HC A06/MF A01

The reliability of results of environmental trace analysis is discussed. After theoretically exploring the factors which influence the quality of analytical data as well as the means by which a sufficient quality can be assured and controlled, schemes of different kinds were developed and applied in order to demonstrate the analytical quality assurance and control in practice. Methods were developed for the determination of cesium, bromine, and arsenic by neutron activation analysis at the natural background concentration level in environmental materials. The calibration of methods is described, i.e., their precision, accuracy, and sensitivity were tested and judged from the standpoint of application. The methods were also applied to practical routine analysis, the results of which are briefly reviewed. The results of IAEA's world-wide intercomparison runs from the period 1969 to 1973 are reviewed to survey the present status of environmental trace analysis. The extensive material available makes it possible to conclude that many laboratories are not in a position to be able to control the reliability of their analytical work; the quality of the results is not assured and controlled and is insufficient in relation to what is needed or what is technically feasible. The results of radiochemical analyses in environmental materials show a reliability somewhat better than that occurring in the determination of stable trace elements. Author (ESA)

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N79-11170 Wyoming Univ., Laramie.
CORRESPONDING STATES: PHASE EQUILIBRIA, EXCESS PROPERTIES AND CRITICAL LOCI OF NONPOLAR MIXTURES Ph.D. Thesis
Wenent Peter Pan 1977 151 p
Avail: Univ. Microfilms Order No. 7818943

The Principle of Corresponding States was used to correlate and predict phase equilibria, critical properties, and excess properties for nonpolar mixtures. The mixing rules and interaction parameters, proposed by Gunn et al., (1974) were adopted. Equations of state were the BWR 44 (Yamada, 1973) for gases and a dense liquid equation (Yamada, 1972) for liquids. The proposed method was found to be more accurate in phase equilibria predictions than the best methods currently available. The average deviations between the calculated and experimental values were 0.0113 mole fraction for the liquid composition and 0.0098 mole fraction for the vapor composition for a total of 45 systems and 2994 points tested over a wide range of temperatures and pressures. This method predicted phase equilibria for mixtures containing nonhydrocarbons as accurately as for hydrocarbon-hydrocarbon mixtures. Dissert. Abstr.

N79-11171 Johns Hopkins Univ., Baltimore, Md.
NONDESTRUCTIVE INVESTIGATION OF THE MECHANICAL DEFORMATION OF 7075 ALUMINUM Ph.D. Thesis
John Christian Duke 1978 90 p
Avail: Univ. Microfilms Order No. 7817938

The acoustic emission occurring during the tensile deformation of 7075-T651, 7075-T6 and 7075 solution treated aluminum alloys are examined in detail. The acoustic emission resulting from dislocation breakaway and generation, the fracture and decohesion of inclusions and intermediate particles and void formation initiated by these fractured particles are described. A description of the observed results is presented and compared with other previously suggested explanations. A discussion of the observed behavior in terms of dislocation mechanisms is presented which explains the difference between the indications of the acoustic emission and ultrasonic attenuation results. Additional individual features of both techniques are explained and several conclusions are drawn. Dissert. Abstr.

N79-11172 Ohio State Univ., Columbus.
DUCTILE FRACTURE OF U-NOTCHED BEND SPECIMENS IN SPHEROIDIZED AISI 1095 STEEL, AISI 4340 STEEL AND DS NICKEL Ph.D. Thesis
Tsvi Goldenberg 1978 159 p
Avail: Univ. Microfilms Order No. 7819604

The behavior of the microstructure of three metals during deformation prior to ductile fracture was investigated with emphasis on the role of void initiation and growth in the plastic zone of notched bend specimens. The materials chosen were spheroidized AISI 1095, AISI 4340 which was quenched and tempered and a dispersion strengthened nickel-base alloys, DS N sub i. The specimens used were U-notched bar type and testing was done in three point bendings. The localized stress-raiser effect of the U-notch added a parameter to the straining procedures. The other parameter was the change in the load during the three point bending test. By incorporating various notch sizes with different loads, changes in the microstructure are related to parameters such as local stress, nominal stress, strain and stress gradient. Dissert. Abstr.

N79-11173 Arizona Univ., Tucson.
SOLIDIFICATION OF NICKEL-BASE ALLOYS CONTAINING TITANIUM AND ALUMINUM Ph.D. Thesis
Glen Allen Vaughn 1978 228 p
Avail: Univ. Microfilms Order No. 7818621

A series of nickel-titanium-aluminum alloys containing approximately 90w/O Ni and varying amounts of titanium and aluminum, was induction-melted in a vacuum of 0.001 torr in either MgO or Al2O3 crucibles and vacuum-cast into either a cylindrical chill or insulating mold. These alloys were investigated to determine their solidification behavior, to establish the effect of solidification rate on microstructure, and to determine the effect of alloy melt-crucible interactions on inclusion formation. Dissert. Abstr.

N79-11174 Aeronautical Research Labs., Melbourne (Australia).
ACTUAL AND PREDICTED FATIGUE LIVES OF D6AC STEEL IN VERY DRY AND FULLY WATER SATURATED AIR ENVIRONMENTS
J. Y. Mann and D. S. Kemsley Oct. 1977 23 p refs
(ARL/Struc-Rept-366; AR-000-857) Copyright. Avail: Issuing Activity

Axial load fatigue tests were carried out on keyhole-notched specimens of D6AC steel (UTS = 1,600 MPa) in very dry air and in air fully saturated with water vapor. These included tests under constant-amplitude and four-load-range program loading in both environments. Crack initiation and propagation lives, and crack propagation rates were estimated from the program markings on the fracture surfaces. Under the four-load-range (standard) program loading sequence the total fatigue lives in a fully water-saturated air environment were about 35% of those in very dry air. In wet air, the crack initiation life under the standard program was about half that in dry air, and the progagation life to failure about one-third of that in dry air. The average crack propagation rate in wet air was up to three times faster than that in dry air. Fatigue life predictions for the programmed loading cases were made using the constant-amplitude fatigue data and the simple Palmgren-Miner linear

cumulative damage hypothesis. For both environments, the predicted program lives were less than the actual lives, the ratio predicted/actual being about 0 to 36 under dry air and about 0 to 33 under wet air conditions. A.R.H.

N79-11175 Aeronautical Research Labs., Melbourne (Australia).
APPLICATION OF COMPLIANCE TECHNIQUES FOR STUDYING THE EFFECT OF SIDE-GROOVING ON STRESS-CORROSION CRACK KINETICS OF A HIGH STRENGTH STEEL
W. J. Pollock Apr. 1978 19 p refs
(ARL/Mat-Note-121; AR-001-262) Copyright. Avail: Issuing Activity

Sub-critical crack growth was estimated from changes in compliance measured during the stress corrosion cracking of D6AC steel at constant load using 1-T wedge-opening-loading specimens. Agreement of calculated mean crack growth with mean values measured from the fracture surface shows that plastic yielding at the crack tip during loading and subsequent stress corrosion cracking was negligible. The analysis was then applied to side-grooved specimens where it was demonstrated that, under plane-strain conditions, side-grooving does not significantly affect the stress corrosion cracking rate in D6AC steel. Author

N79-11176 Materials Research Labs., Melbourne (Australia).
EFFECT OF AGEING ON THE HARDNESS AND TENSILE PROPERTIES OF ALUMINUM ALLOY 7001 WITH SPECIAL REFERENCE TO THE INFLUENCE OF DELAY TIME BETWEEN THE QUENCHING AND AGEING TREATMENTS
J. H. Cole Mar. 1978 19 p refs
(MRL-TN-411; AR-000-889) Copyright. Avail: Issuing Activity

The change in hardness of aluminum alloy 7001 with time at temperatures 22 C, 50 C and 121 C following quenching from solution heat treatment at 460 C was determined. At 22 C, natural aging caused a hardness increase from 104 HV to 191 HV in 6 1/2 years and the hardness was still rising. Aging at 50 C caused an increase in hardness from 104 HV to 179 HV in 96 h and the hardness was still rising. After approximately 72 h at 121 C, a peak hardness of 216 HV was reached. Subsequent heating at 121 C after various periods of time up to 4 years at 22 C and 96 h at 50 C caused an initial reversion in hardness. Delay times varying from zero to 217 days at 22 C between quenching and aging at 121 C for 24 h did not appear to have any significant effect on the hardness and tensile properties. Author

N79-11177# Naval Postgraduate School, Monterey, Calif.
EFFECTS OF HYDRODYNAMIC VARIABLES ON CORROSION: STUDY OF 90/10 Cu-Ni IN A FLOW CHANNEL WITH NATURAL SEA WATER M.S. Thesis
Robert Paul Schack Mar. 1978 134 p refs
(AD-A056325) Avail: NTIS HC A07/MF A01 CSCL 11/6

The effects of hydrodynamic variables on the corrosion rate of 90/10 Cu-Ni were studied in sea water pumped from Monterey Bay. A one centimeter square flow channel was built providing a maximum flow velocity of 7.8 m/sec. The flow field was examined using hot film anemometry in an attempt to correlate variables such as turbulence intensity to corrosion rate. General concepts of turbulence that may affect corrosion were discussed with a view toward resolving the disparities in reported corrosion data taken under different flow situations. Possible leading edge effects due to the establishment of the mass transfer boundary layer were investigated and found to be negligible in 48 hour tests, provided care was taken to avoid crevices or mismatches in the channel wall. Author (GRA)

N79-11178*# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Metallurgy and Materials Science.
DEFORMATION AND ANNEALING STUDY OF NiCrAlY
L. J. Ebert and D. M. Trela Oct. 1978 76 p refs
(Grant NGR-36-003-094)
(NASA-CR-157925) Avail: NTIS HC A05/MF A01 CSCL 11F

The elevated temperature properties (tensile and creep) of NiCrALY, a nickel base alloy containing nominally 16% chromium, 4% aluminum, and 2 to 3% yttria (Y2O3) were evaluated and the optimal combination of thermomechanical treatments for maximum creep resistance was determined. Stored strain energy in as-extruded bars (14:1 extrusion ratio) permitted the development of a large grain size in the material when it was annealed at the maximum safe temperature 2450 F (1343 C). With a one-hour anneal at this temperature, the relatively fine grain size of the as-extruded material was changed to one in which the average grain diameter approached 1 mm, and the aspect ratio was about 10. The material was capable of being cold worked (by rolling) in amounts greater than 30% reduction in area. When the cold worked material was given a relaxation treatment, consisting of heating one hour at 1600 F(871 C), and then a high temperature anneal at 2450 F (1343 C) for one hour, both the high temperature strength and the high temperature creep resistance of the material was further enhanced. A.R.H.

N79-11179*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL BARRIER COATINGS: BURNER RIG HOT CORROSION TEST RESULTS Final Report
Philip E. Hodge, Stephen Stecura, Michael A. Gedwill, Isidor Zaplatynsky, and Stanley R. Levine Oct. 1978 35 p refs
(Contract EF-77-A-01-2593)
(NASA-TM-79005; E-9787; DOE/NASA/2593-78/3) Avail: NTIS HC A03/MF A01 CSCL 11F

A Mach 0.3 burner rig test program was conducted to examine the sensitivity of thermal barrier coatings to Na and V contaminated combustion gases simulating potential utility gas turbine environments. Coating life of the standard ZrO2-12Y2O3/Ni-16.2Cr-5.6Al-0.6Y NASA thermal barrier coating system which was developed for aircraft gas turbines was significantly reduced in such environments. Two thermal barrier coating systems, Ca2SiO4/Ni-16.2Cr-5.6Al-0.6Y and ZrO2-8Y2O3/Ni-16.4Cr-5.1Al-0.15Y and a less insulative cermet coating system, 50 volume percent MgO-50 volume percent Ni-19.6Cr-17.1Al-0.97Y/Ni-16.2Cr-5.6Al-0.6Y, were identified as having much improved corrosion resistance compared to the standard coating. Author

N79-11180*# TRW, Inc., Cleveland, Ohio.
EXPLORATORY THERMAL-MECHANICAL FATIGUE RESULTS FOR RENE' 80 IN ULTRAHIGH VACUUM Final Report, 11 Jul. 1977 - 11 Jul. 1978
A. A. Sheinker Oct. 1978 23 p refs
(Contract NAS3-21019)
(NASA-CR-159444; TRW-ER-8028) Avail: NTIS HC A03/MF A01 CSCL 11F

A limited study was conducted of the use of strainage partitioning for predicting the thermalmechanical fatigue life of cast nickel-base superalloy Rene' 80. The fatigue lives obtained by combined inphase thermal and mechanical strain cycling between 400 C (752 F) and 1000 C (1802 F) in an ultrahigh vacuum were considerably shorter than those represented by the four basic partitioned inelastic strainrange fatigue life relationships established previously for this alloy at 871 C (1600 F) and 1000 C (1832 F) in an ultrahigh vacuum. This behavior was attributed to the drastic decrease in ductility with decreasing temperature for this alloy. These results indicated that the prediction of the thermal-mechanical fatigue life of Rene' 80 by the method of strainrange partioning may be improved if based on the four basic fatigue life relationships determined at a lower temperature in the thermal-mechanical strain cycle.
Author

N79-11181# Naval Ship Research and Development Center, Bethesda, Md.
ELASTIC-PLASTIC FRACTURE TOUGHNESS (J SUB IC) OF HIGH-STRENGTH STEELS AND TITANIUM ALLOYS
John P. Gudas and James A. Joyce Jun. 1978 39 p refs
(AD-A056091; DTNSRDC-78/054) Avail: NTIS HC A03/MF A01 CSCL 11/6

The elastic-plastic fracture toughness parameter J sub IC has been determined for HY 80, HY 130, 10 Ni steel, 17-4PH steel, and titanium alloys Ti-6Al-2Cb-1Ta-0.8Mo, Ti-7Al-2Cb-1Ta, and Ti-6Al-4V. Tests were carried out at room temperature by use of a multiple-specimen test method and a newly developed single-specimen computer interactive test procedure. J sub I is shown to be an effective parameter in describing fracture

toughness on the basis of both crack initiation and crack-growth resistance. The computer interactive test procedure is shown to produce equivalent results when compared with the multiple-specimen test method and possesses distinct advantages over that method. Author (GRA)

N79-11182# Boeing Commercial Airplane Co., Seattle, Wash.
ANODIZE OPTIMIZATION AND ADHESIVE EVALUATION FOR REPAIR APPLICATIONS Interim Report, 1 Dec. 1976 - 30 Sep. 1977
M. C. Locke, R. E. Horton, and J. E. McCarty Jan. 1978 108 p refs
(Contract F33615-73-C-5171)
(AD-A056606; AFML-TR-78-7) Avail: NTIS HC A06/MF A01 CSCL 13/8

This report covers Task I of a two-task follow-on program to investigate phosphoric acid non-tank anodize process optimization and evaluation of adhesive/surface preparation combinations. Work completed in Task I included investigating non-tank anodizing process variables of voltage, time, temperature, and rinse delay. Other parameters studied included the effect of anodizing over titanium and aluminum fasteners, battery anodizing, anodizing mode, and identification of common errors occurring in non-tank anodizing. Following the anodizing variables investigation, bond verification tests were conducted to assess bondability of representative RT, 250 F, and 350 F cure adhesive systems. This work will serve as a basis for selecting the phosphoric acid non-tank anodize process parameter/conditions for Task II. Author (GRA)

N79-11183# Harvard Univ., Cambridge, Mass. Div. of Applied Sciences.
STRUCTURAL IMPERFECTIONS IN AMORPHOUS METALS
Frans Spaepen May 1978 33 p refs
(Contract N00014-77-C-0002)
(AD-A056247; TR-4) Avail: NTIS HC A03/MF A01 CSCL 11/6

The experimental evidence of the existence and nature of imperfections in amorphous metals is reviewed. It derives from observations of microscopic homogeneity, density measurements, positron annihilation studies, inhomogeneous flow and measurements of the various atomic transport coefficients: shear viscosity, diffusivity, structural relaxation rate and crystal growth rate. In contrast with crystal imperfections, which tend to be discrete and localized due to the constraints imposed by the long range periodicity, imperfections in amorphous metals tend to be more extended and diffuse. This is illustrated by the collapse and annihilation of a vacancy in a two-dimensional amorphous dynamic hard sphere model, and the observations are generalized for other defects in three dimensions. It is concluded that the most fruitful way of describing defects in amorphous metals is as sites with small local perturbations of the 'ideal' short range order, which allows local configurational rearrangements. It is suggested that different types of rearrangement (nearest neighbor changes, shear, volume annihilation) are possible at different sites, and that the concentration and lifetime of each type of site determines the time constant of the corresponding atomic transport process. Author (GRA)

N79-11184# Army Armament Research and Development Command, Dover, N. J. Large Caliber Weapon Systems Lab.
CHROMATE-FREE METHOD OF PREPARING ALUMINUM SURFACES FOR ADHESIVE BONDING: AN ETCHANT COMPOSITION OF LOW TOXICITY Technical Report, Oct. 1976 - 30 Sep. 1977
William J. Russell and Elizabeth A. Garvis May 1978 29 p refs
(AD-A056241; AD-E400160; ARLCD-TR-78001) Avail: NTIS HC A03/MF A01 CSCL 13/8

In a continuing effort to minimize the use of toxic and hazardous materials for the adhesive bonding of aluminum, a suitable alternative for the standard chromate-containing FPL etchant is being sought. This has resulted in the development of a chromate-free etchant of minimal toxicity (etchant P2) which consists of an aqueous solution of sulfuric acid and ferric sulfate. Surfaces produced with the new etchant composition when adhesively bonded, result in joint strengths comparable to those obtained with the standard chromated etchant. Adhesively bonded 6061-T4 alloy specimens prepared with the new etchant exhibited stress durabilities superior to those prepared with the standard FPL etchant. No difficulties are expected to result from the use of the new etchant under production conditions. Author (GRA)

N79-11185# Naval Postgraduate School, Monterey, Calif. Dept. of Mechanical Engineering.
MORPHOLOGICAL EVIDENCE FOR A PITTING MECHANISM IN DILUTE ALUMINUM ALLOYS Interim Report, Mar. - Jun. 1978
J. Perkins, J. R. Cummings, and K. J. Graham Jun. 1978 24 p refs
(RR0220801)
(AD-A056297; NPS-69-PS-78-005; NPS-TR-9) Avail: NTIS HC A02/MF A01 CSCL 11/6

In the course of an investigation of the seawater corrosion behavior of several dilute aluminum alloys, direct microscopic evidence of pitting phenomena was obtained. Observations, obtained by scanning electron microscopy after galvanic corrosion exposures, illustrate a pitting mechanism involving the extrusion of columns of corrosion product from pits by the action of hydrogen gas generated inside the pits. The macroscopic dissolution patterns of the various alloys and their respective microscopi dissolution morphologies are also described. The observations support the classical model for pitting of aluminum originally presented by Edeleanu and Evans. Author (GRA)

N79-11186# Rhode Island Univ., Kingston. Dept. of Ocean Engineering.
RAMAN SPECTRA OF POSSIBLE CORROSION PRODUCTS OF IRON Interim Report
Richard J. Thibeau, Chris W. Brown, and Robert H. Heidersbach Jun. 1978 21 p refs
(Contract N00014-76-C-0889)
(AD-A056298; TR-3) Avail: NTIS HC A02/MF A01 CSCL 07/4

Raman spectra of FeO, Fe3O4, alpha-Fe2O3, alpha-FeOOH, and gamma-FeOOH, the common products of iron oxidation, have been measured. The spectra of FeO and Fe3O4 appear to be identical. Armco iron oxidized in air at 250 C was examined by Raman spectroscopy after varying periods of exposure and the surface film was found to contain Fe3O4 and alpha-Fe2O3. GRA

N79-11187# SRI International Corp., Menlo Park, Calif.
EFFECTS OF GRAIN SIZE ON QUASISTATIC AND DYNAMIC FRACTURE OF TITANIUM Final Technical Report, 1 Apr. 1975 - 31 Mar. 1978
D. A. Shockey, K. C. Dao, and R. L. Jones May 1978 79 p refs
(Contract DAAG29-75-C-0020)
(AD-A057373; ARO-12560.2-MS) Avail: NTIS HC A05/MF A01 CSCL 11/6

The feasibility of establishing quantitative relationships between microstructural features and dynamic fracture behavior was investigated by performing plate impact experiments on specimens of alpha titanium differing predominantly in grain size, and determining values of parameters describing microfracture nucleation and growth. The dynamic fracture strengths for materials having average grain diameters of 36 micro m and 1.5 micro m were essentially identical, but threshold nucleation rates, nucleation stress sensitivities, and microfracture growth viscosities differed by factors of 2 to 3. The coarse-grained material exhibited superior dynamic fracture resistance even though its quasi-static yield and ultimate tensile strengths were significantly lower than those of the fine-grained material. An explanation for this reversal in behavior is given in terms of the microstructure and the microfracture kinetics. Author (GRA)

N79-11188# Boeing Aerospace Co., Seattle, Wash.
CAST ALUMINUM STRUCTURES TECHNOLOGY, PHASE 3 (CAST) Final Report, Feb. - Dec. 1977
Donald Goehler Jan. 1978 135 p refs
(Contract F33615-76-C-3111; AF Proj. 486U)
(AD-A057422; D180-22807-1; AFFDL-TR-78-7) Avail: NTIS HC A07/MF A01 CSCL 01/3

The objective of CAST is to establish the necessary structural and manufacturing technologies and to demonstrate and validate the integrity, producibility, and viability of cast aluminum primary airframe structures. The baseline design is the AMST prototype YC-14 and the component selected was the Nose Landing Gear Support Bulkhead. Detail design activities are described that were aimed at providing a cast bulkhead design for production with no weight penalty and at a minimum of 30 percent acquisition cost savings. A detail design was completed that resulted in a 6.5-pound weight savings and an estimated 37.7 percent cost saving. Author (GRA)

N79-11189# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.

MECHANISM OF CORROSION FATIGUE OF STEEL AND TITANIUM ALLOYS Semiannual Report, 30 Jun. 1978

G. W. Simmons and R. P. Wei 3 Jul. 1978 16 p refs

(Contract N00014-75-C-0543)

(AD-A057313) Avail: NTIS HC A02/MF A01 CSCL 11/6

The kinetics of subcritical-crack growth under sustained load in 3.5 pct NaCl solution have been determined over a range of temperatures from 3 to 90 C. 0.64 cm (1/4 in.) thick wedge-opening-load (WOL) specimens were used. A well defined K-independent stage (Stage II) of growth was observed at each temperature, and the rate was controlled by a thermally activated process having an apparent activation energy of 20 plus or minus 5 kJ/mol (on a 95 pct confidence level basis). These Stage II rates were substantially higher than those reported by Williams and Nelson, at corresponding temperatures, for this alloy tested in hydrogen at 0.9 atm. The apparent activation energy for crack growth in these two environments, however, are statistically equivalent. No identification of the rate controlling process (or processes) has been made. GRA

N79-11190# Minnesota Univ., Minneapolis.

ANALYSIS OF THE DUCTILE-BRITTLE TRANSITION TEMPERATURE IN Fe-BINARY ALLOYS Final Report, May 1974 - Jul. 1977

W. W. Gerberich Mar. 1978 11 p refs

(Contract EY-76-S-02-2212)

(TID-28431) Avail: NTIS HC A02/MF A01

Flow and fracture characteristics in binary alloys of iron are studied as well as other crack growth mechanisms in high strength steel and nickel-based alloys. DOE

N79-11191# California Univ., Berkeley. Lawrence Berkeley Lab.

ANGLE-RESOLVED PHOTOELECTRON SPECTROSCOPY APPLIED TO THE DETERMINATION OF THE SURFACE ELECTRONIC STRUCTURE OF CRYSTALLINE METALS Ph.D. Thesis

Richard Stanley Williams May 1978 181 p refs

(Contract W-7405-eng-48)

(LBL-7676) Avail: NTIS HC A09/MF A01

Photoemission from atomic neon is examined theoretically to learn the nature of the continuum final state and its relation to the total and differential atomic cross sections. The directionality of the band-like final states in a crystalline solid is then determined by examining angle resolved photoelectron spectroscopy (ARPES) spectra collected from Cu single crystals. Attenuation of photocurrent is studied by determining the surface sensitivity of plasmon loss satellites in photoemission spectra of Al and In. The effect of photocurrent damping on ARPES valence band spectra of copper is then investigated by examining the relaxation of crystal momentum selection rules with increased surface sensitivity. Photoemission is also possible from states localized at the surface, and examples of surface state photoemission are found from the (111) and (211) surfaces of copper. The dynamic effects of thermal lattice disordering are considered. DOE

N79-11192# California Univ., Berkeley. Lawrence Berkeley Lab.

IMPROVED FORMABILITY OF ALUMINUM-GERMANIUM NEAR EUTECTIC COMPOSITIONS THROUGH THE APPLICATION OF SUPERPLASTICITY PRINCIPLES M.S. Thesis

G. J. Pech Dec. 1977 54 p refs

(Contract W-7405-eng-48)

(LBL-7300) Avail: NTIS HC A04/MF A01

The 80-20 and 70-30 atomic percent Al-Ge compositions, which are used in the Nb3(Al,Ge) superconducting material, were investigated. These alloys are brittle at room temperature, but were deformed plastically in this study by simulating conditions that have produced superplasticity in similar materials. The microstructure of these Al-Ge compositions was controlled to produce an inherently ductile structure of Ge spheroids dispersed throughout an Al matrix. A very fast cooling rate followed by a short anneal of 7 minutes at 400 C was found to produce a fine homogenous spheroidal structure in 0.5 inch diameter castings. Vickers microhardness tests were performed on castings of lamellar and fibrous microstructures after anneals at temperatures from 300 to 400 C. The deformation behavior of castings subjected to various conditions was reported. Parameters such as microstructure, temperature, % reduction, and anneals were investigated, and the results were used to successfully reduce Al-Ge castings to wire. DOE

N79-11193# Oak Ridge National Lab., Tenn.

SPUTTERING AND CHEMICAL ATTACK OF 304 STAINLESS STEEL, ALUMINUM, AND GOLD BY HYDROGEN IONS OF 100 eV ENERGY

R. E. Clausing, L. C. Emerson, and L. Heatherly 1978 7 p Presented at the 3rd Conf. on Plasma Interaction in Controlled Fusion Devices, Abingdon, Oxfordshire (England), 3 Apr. 1978 (Contract W-7405-eng-26)

(CONF-780431-10) Avail: NTIS HC A02/MF A01

Samples of polished and oxidized 304 stainless steel, aluminum, and gold was subjected to bombardment by hydrogen ions in order to simulate effects expected in Tokamak fusion devices. The sputtering and chemical effects of bombardment with 100 and 200 eV ions to fluence levels of 2 x 10 to the 21st power ions/sq cm and 4 x 10 to the 21st power ions/sq cm respectively are reported. Under these conditions gold was badly blistered and eroded, aluminum was slightly blistered at 100 eV and substantially eroded at 200 eV but few changes are seen in the polished stainless steel. The oxide film (produced by a 1/2 hr exposure to air at 500 C) on the polished sample was, however, removed and only a very thin layer of substoichiometric oxide remained on the surface after exposure to either 100 or 200 eV hydrogen plasmas. Sample temperatures during bombardment were about 50 C for the 100 eV ions and 65 C for the 200 eV ions. DOE

N79-11194# Sandia Labs., Livermore, Calif. Material Science Div.

SOLID METAL EMBRITTLEMENT OF Ti-6Al-6V-Sn BY CADMIUM, SILVER, AND GOLD

R. E. Stolz and R. H. Stulen May 1978 25 p refs

(Contract EY-76-C-04-0789)

(SAND-78-8653) Avail: NTIS HC A02/MF A01

Solid metal embrittlement of Ti-6A1-6V-2Sn were observed with Cd, Ag, and An. A threshold temperature of 477 to 505 K exists for Ag and Au, below which no embrittlement was observed. Embrittlement by Cd at 421 K was confirmed. No embrittlement due to Cu or Ni was observed at temperatures as high as 560 K. Scanning Auger analysis of Ag and Cd embrittled samples indicated that: (1) the fracture path is intergranular, (2) surface diffusion is the limiting transport mechanism, and (3) surface diffusion of Cd and Ag is over the titanium oxide. The fracture process is discussed in relation to liquid metal embrittlement. DOE

N79-11195# Oak Ridge Inst. of Nuclear Studies, Inc., Tenn. Dept. of Special Services.

EVALUATION OF THE EFFECT OF IMPURITIES IN NICKEL PLATE DEPOSITED FROM A WATTS-TYPE BATH

C. E. Daugherty and G. S. Petit May 1978 17 p refs

(K-1893) Avail: NTIS HC A02/MF A01

The effects of less than or equal to 5 ppM of an octyl ortho-phthalate ester and varied amounts of iron contamination on the hardness of nickel plate deposited from a Watts-type nickel plating bath was studied. The effect of iron contamination on the plate hardness was evaluated at 200, 400, 800, and 1,200 ppM in the bath. The amount of iron codeposited with the nickel at the various levels of iron contamination in the bath was also evaluated. DOE

N79-11196# California Univ., Berkeley. Lawrence Berkeley Lab.
INVESTIGATION OF WEAR RESISTANT MATERIAL USING DISPERSED PHASE INTERMETALLIC COMPOUND OF NICKEL-TITANIUM-SILICON IN AN IRON MATRIX M.S. Thesis
C. Steinmetz Dec. 1977 65 p refs
(Contract W-7405-eng-48)
(LBL-6983) Avail: NTIS HC A04/MF A01

The physical and mechanical properties of iron powder blended with a hard intermetallic compound, Ni3Ti2Si, were studied in the as-sintered condition. The influence of the morphology on the wear tests was investigated using a pin-on-disk wear test machine. The variables affecting the morphology of this system were experimentally determined. DOE

N79-11197# Sandia Labs., Albuquerque, N. Mex.
MECHANICAL PROPERTIES DATA OF CANDIDATE ALLOYS FOR EARTH PENETRATOR STRUCTURAL COMPONENTS
J. A. VanDenAvyle Apr. 1978 50 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0462) Avail: NTIS HC A03/MF A01

Loading modes imposed on earth penetrators during impact and subsurface travel included high rate axial compressive stresses and possibly large tensile bending stresses caused by off-axis impacts or collisions with hard subsurface objects. These modes required that case structural alloys possess a high yield strength to prevent yielding under compressive loads and also possess high fracture toughness to resist fracture under tensile loading at stress concentrations. Tensile data were generated at intermediate strain rates between 219 and 344 K for four candidate steels (9-4-20, maraging 250, HY-180, and D6AC). In general, yield strengths varied less than 10 percent over the ranges of strain rate and temperature tested. Charpy impact energy measurements on 9-4-20 showed a 10 percent decrease in toughness at low temperatures for samples subjected to a simulated heat-shrink fitting procedure. DOE

N79-11198# California Univ., Livermore. Lawrence Livermore Lab.
COMPARISON OF THE ACOUSTIC EMISSION GENERATED BY TENSILE AND COMPRESSIVE TESTING OF 7075 ALUMINUM
M. A. Hamstad and A. K. Mukherjee 28 Apr. 1978 22 p refs
(Contract W-7405-eng-48)
(UCID-17787) Avail: NTIS HC A02/MF A01

The acoustic emission generated during tensile and compression testing of unflawed 7075 aluminum was completed. Variables studied included: specimen orientation in a 13 cm plate, 1, 3 and 4.8 percent plastic stretches before the aging heat treatment, and 7075-T6 vs 7075-T651. The level of acoustic emission for strains greater than 1.5 percent was about two orders of magnitude greater in tension than in compression. In the T-6 state the acoustic emission level generated at first macroscopic yielding is about the same in both tension and compression tests. Samples of 7075-T6 can be distinguished from 7075-T651 by the acoustic emission generated during a simple compression test and for both tension and compression tests the acoustic emission is of higher level when the loading axis is perpendicular to the rolling plane. DOE

N79-11199# Arizona Univ., Tucson. Optical Sciences Center.
STUDY OF OXIDE INTERLAYERS FORMED REACTIVELY AT A SILVER-ELECTROLYTE BOUNDARY
S. O. Sari and E. D. Huber 1978 12 p refs
(Contract EG-77-S-02-4381)
(COO-4381-4) Avail: NTIS HC A02/MF A01

The differential reflectance of reactively oxidized versus unoxidized silver foils in aqueous potassium hydroxide was measured in the 1.5 to 5 eV energy range. From these results the imaginary part of the dielectric constant of the oxide can be determined directly in the free-electron region of silver, and the zero-frequency interband contribution to the dielectric function of the oxide-covered metal can be estimated. The scattering contribution to the reflectance from the oxide surface nonuniformities is discussed. DOE

N79-11200# California Univ., Berkeley. Lawrence Berkeley Lab.
MECHANISMS OF MATERIAL REMOVAL IN SOLID PARTICLE EROSION OF DUCTILE MATERIALS M.S. Thesis
R. A. Mayville Jun. 1978 41 p refs
(Contract W-7405-eng-48)
(LBL-7333) Avail: NTIS HC A03/MF A01

The mechanisms by which material is removed from a ductile metal surface when subjected to the impingement of a stream of angular abrasive particles was determined. The particular case considered is one where the stream impinges at angles that are nearly normal to the average surface. In this case, material appears to be removed in the form of the platelets that result when a protrusion from the average surface is severely plastically deformed (as if being spread over the surface) by the impingement of a smooth side of a particle. DOE

N79-11201# Trans-Tech Translations, Seattle, Wash.
STUDY OF THE REVERSIBLE TEMPER BRITTLENESS KINETICS FOR CARBON STEELS AND LIGHTLY ALLOYED STEELS
J. Lagrange 25 Apr. 1978 11 p refs Transl. from Mem. Sci. Rev. Met. (Paris), v. 74, 1977 p 757-763 Presented at 16th Meeting on Spec. Steels, Belfort, France, 11-13, May 1977 Sponsored by DOE Prepared for Battelle Pacific Northwest Labs., Richland, Wash.
(BNWL-TR-310; Conf-7705126-1) Avail: NTIS HC A02/MF A01

To establish a mathematical model which represents with sufficient accuracy the kinetics of reversible temper embrittlement, collection of the results obtained on SAE 3140 Ni-Cr steel were studied. On the basis of these transition curves, a mathematical model which utilizes theories and results was proposed. The model assumes three principal functions: (1) segregation; (2) diffusion; and (3) reversion. The segregation function is based on McLean's theory, picked up by Hondros, Seah and Guttmann. The diffusion function finds the diffusiveness value of phosphor in the iron alpha given by Gruzin and Mural. The reversion function expresses an indisputable reality of embrittlement reversion at 525 and 575 C. The proposed model assumes for an initial embrittlement of over 100 C alpha level sigma dispersion of 8 C. DOE

N79-11202# Sulzer Bros. Ltd., Winterthur (Switzerland). Lab. Neue Werkstoffe.
DEVELOPMENT OF SUITABLE METHODS FOR TESTING THE CORROSION RESISTANCE OF GAS TURBINE ALLOYS AND PROTECTIVE LAYERS European Concerted Action. COST 50 - Materials for Gas Turbines. Final Report [ENTWICKLUNG GEEIGNETER METHODEN ZUR PRUEFUNG DER KORROSIONSBESTAENDIGKEIT VON GASTURBINEN-LEGIERUNGEN UND SCHUTZSCHICHTEN]
P. C. Felix (Brown, Boveri & Co. Ltd., Baden, Switz.) and P. Huber Aug. 1977 40 p refs In GERMAN Sponsored by Schweiz. Eidgenossenschaft
Avail: NTIS HC A03/MF A01

Pilot tests for the evaluation of possible turbine blade material and for the estimation of the influence of corrosion parameters such as concentration of corrosive fuel constituents, temperature, pressure, etc. are reported. The corrosion resistance of the alloys tested can be classified into approx. equal to (IN 738LC, U710, IN939, IN597, IN587, Nimonic 81, C73), somewhat less than (U500, IN853, Nimonic 80A, MAR M509, X-40, X-45), clearly less than (IN793, MAR M432, Nimonic 90, FSX-414), and very much less than (Nimonic 105, MAR M002, MAR M421, U 700, MAR M246, IN 713LC) that of IN738LC. ESA

N79-11203# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne (West Germany). Inst. fuer Werkstoff-forschung.
INFLUENCE OF THERMOMECHANICAL TREATMENT ON MICROSTRUCTURE AND MECHANICAL PROPERTIES OF HIGH STRENGTH ALUMINUM ALLOYS Ph.D. Thesis - Ruhr Univ., Bochum, West Ger.
Karl Welpmann, Gerd Luetjering (Ruhr Univ.), and Wolfgang Bunk 23 Nov. 1977 79 p refs In GERMAN; ENGLISH summary Report will also be announced as translation (ESA-TT-507)

(DLR-FB-77-50) Avail: NTIS HC A05/MF A01; DFVLR, Cologne DM 40,70

Thermomechanical treatment (TMT) tests on AlZnMgCu alloys were made. The inhomogeneous slip which occurs during the rolling process produced shear offsets at the grain boundaries and so reduced the effective grain boundary length. In a pure alloy without Fe, Si and Cr this microstructural modification caused an improvement of various mechanical properties. The tensile ductility and the lifetime in the fatigue tests increased. The SCC resistance of the alloy was enhanced, and the fracture toughness values were raised. The fatigue crack propagation behavior in the high crack propagation rate regime was improved. At low crack propagation rates the cracks propagated along slip bands and the TMT caused a deterioration of the crack propagation behavior. The commercial AlZnMgCu alloys also showed microstructural modifications at the grain boundaries produced by the TMT. The influence of the grain boundaries on the deformation, crack initiation, and crack propagation mechanisms is not a dominant factor and the mechanical properties were found to be only slightly affected by the TMT. Author (ESA)

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N79-11204 Massachusetts Univ., Amherst.
DYNAMIC MECHANICAL AND MELT RHEOLOGICAL PROPERTIES OF ETHYLENE COPOLYMERS AND IONOMERS Ph.D. Thesis
Thomas Robert Ernest, Jr. 1978 175 p
Avail: Univ. Microfilms Order No. 7816254

The dynamic mechanical and melt rheological properties of ethylene-methacrylic acid copolymers, their methyl esters, and sodium salts (ionomers) were investigated. Differences in the melt rheology for the acid and ester copolymers were explained by differences in glass transition temperatures. Time-temperature superposition was found applicable for the nonionic derivatives, and shift factors were fitted to a WLF equation. Time-temperature superposition was not applicable for the ionomers. By maximizing overlap at either low or high frequencies for the ionic polymers, pseudo-master curves were constructed which indicate that at least two mechanisms of flow occur in the ionomers. It was found that temperature shifts required to superpose master curves for the three derivatives (ester, acid and salt) were related to the strength of interactions involved in hydrogen bonding and ionic multiplet formation. Dissert. Abstr.

N79-11205 Akron Univ., Ohio.
MECHANISMS OF GEL PERMEATION CHROMATOGRAPHIC SEPARATIONS OF POLYMERS Ph.D. Thesis
Chi-San Wu 1978 126 p
Avail: Univ. Microfilms Order No. 7819085

Gel permeation chromatography (GPC) is usually analyzed as a strictly hydrodynamic flow process. For polymers, the flow can be modeled with or without a shear contribution, that is, a hydrodynamic process related to the viscosity size or the sedimentation size. The sedimentation coefficients and the intrinsic viscosities of samples of poly(dimethylsiloxane) (PDMS) were determined and analyzed, in terms of the current theories of polymer molecules in solution. The PDMS sample and previously characterized samples of polystyrene (PS) were then used in GPC studies. By comparative studies of universal calibration curves of PS and PDMS, obtained from the viscosity hydrodynamic volume, it was found that either of the two hydrodynamic volumes can serve equally well as a calibration parameter. Dissert. Abstr.

N79-11206 Wisconsin Univ., Madison.
SEGMENTED COPOLYMERS: MORPHOLOGICAL RHEO-OPTICAL AND DIELECTRIC STUDIES Ph.D. Thesis
Amnuey Lilaonitkul 1978 311 p
Avail: Univ. Microfilms Order No. 7814272

The structure-property relationships of polytetramethylene oxidepolytetramethylene terephthalate segmented copolymers were investigated using small angle light scattering, polarized light microscopy, dynamic dielectric and mechanical testing, differential scanning calorimetry, and simultaneous stress-strained-infrared dichroism techniques. The elastomeric phase consists of a nearly compatible mixture of uncrystallized hard segments and soft segments. Glass transition temperatures obtained by thermal analysis show a variation with composition which can be described by the Gordon-Taylor equation. Dielectric relaxation studies also indicate a progressive increase of the glass transition activation energy with increasing hard segment composition. An ultra-low frequency (ULF) a.c. dielectric measuring system which extends the testing frequency range down to 0.0001 Hz is discussed. Dissert. Abstr.

N79-11207 University of Southern Mississippi, Hattiesburg.
THE DEVELOPMENT OF NOVEL THERMOSETTING EMULSIONS CONTAINING VARIOUS SILICON MOIETIES Ph.D. Thesis
Tommy Randy Bourne 1978 250 p
Avail: Univ. Microfilms Order No. 7818952

Crosslinkable copolymers were generated by the emulsion copolymerization of various gamma-methacryloxypropyl-alkoxy silanes or trimethylsilyl-ethers with alkyl acrylate and methacrylate type monomers. The emulsion copolymerization process, surractant type and concentration, temperature and coreactants were optimized so that the effect of the concentration, steric hindrance to hydrolysis, and number of hydrolyzable sites of the crosslinkable monomer on the degree of crosslinking and stability could be determined. Emulsion systems of alkoxy-silanes and alkyl acrylates yield copolymers that crosslink at room temperature to give enhanced coating properties while maintaining their flow and coalescing capabilities and acceptable shelf-like. Dissert. Abstr.

N79-11208 Akron Univ., Ohio.
EMULSION POLYMERIZATION OF ACENAPHTHYLENE Ph.D. Thesis
Chi-Yu Chen 1978 283 p
Avail: Univ. Microfilms Order No. 7819064

Acenaphthylene was shown by ultraviolet-absorption spectroscopy to exhibit measurable solubility in water, and was shown to be solubilized by sodium oleate emulsifier micelles. The mixture of acenaphthylene-sodium oleate-water was considered, therefore, to be a true emulsion system despite the fact that the majority of acenaphthylene existed as discrete solid crystals. The apparent activation energy in the temperature range of 50 to 65 C (estimated to be 122 kj/mol) was attributed to the steric effect of the bulky naphthalene ring in the propagation stage. Spectroscopic studies (IR, NMR, X-ray, and electron diffraction) showed the emulsion polyacenaphthylene to be predominantly threodisyndiotactic and paracrystalline. An infrared amorphous band at 670 cm/1 was identified. Dissert. Abstr.

N79-11209 Akron Univ., Ohio.
CHARACTERIZATION OF SEQUENCE DISTRIBUTION IN ACRYLONITRILE COPOLYMERS Ph.D. Thesis
Jae Hong Choi 1978 224 p
Avail: Univ. Microfilms Order No. 7819066

Proton magnetic resonance spectra of copolymers of acrylonitrile with methyl acrylate and styrene prepared by solution and/or bulk polymerization were investigated. Acrylonitrile-and methyl acrylate-centered triad distributions of acrylonitrile-methyl acrylate copolymers were evaluated from their methoxy and methine proton resonance patterns. The results were in good agreement with calculated triad distributions based on reactivity ratios of 1.24 and 0.63 for acrylonitrile and methyl acrylate, respectively. Acrylonitrile- and styrene-centered triad distributions of deuterated copolymers were evaluated from their methine proton resonance patterns. The results were in fair agreement with calculated triad distributions based on reactivity ratios of 0.37 and 0.07 for styrene and acrylonitrile, respectively. Resolution was inadequate to obtain reliable statistical evaluations of acrylonitrile-styrene copolymers from their methine proton resonances. Dissert. Abstr.

N79-11210 Akron Univ., Ohio.
SYNTHESIS OF BLOCK COPOLYMERS WITH SEQUENTIAL INITIATORS Ph.D. Thesis
Binnur-Zeynep Gunesin-Minard 1978 277 p

Avail: Univ. Microfilms Order No. 7819071

Block copolymers were synthesized using butyl acrylate or isoprene and methyl methacrylate as the monomers and di-t-butyl-4,4'-azobisiso-[-cyanoperoxy valerate]as the trifunctional initiator. The possibility of selective activation of this initiator played a key role in the preparation of block copolymers in two polymerization steps. A poly(methyl methacrylate) polymeric initiator was prepared via initiation of methyl methacrylate monomer by peroxy groups which were activated by tetraethylene pentamine at room temperature. In the second stage, this polymeric initiator, with an active diazo group in the center, initiated the butyl acrylate or isoprene polymerization to form the block copolymer. A selective separation technique was used to separate the block copolymers from the homopolymers. A higher percentage of the block copolymer was found to be a triblock due to the termination mechanism involved.

Dissert. Abstr.

N79-11211 Akron Univ., Ohio.

A STUDY OF THE KINETICS AND MECHANISM OF THERMALLY INDUCED SOLID STATE POLYMERIZATION OF HEXAMETHYLENEDIAMMONIUM ADIPATE Ph.D. Thesis

Prasad Dasgupta 1978 162 p

Avail: Univ. Microfilms Order No. 7819067

The major objective was to elucidate the reaction mechanism of thermally induced, solid state polymerization of hexamethylene diammonium adipate, commonly know as nylon 66, below its melting point. Isothermal polymerizations were carried out at temperatures between 160 and 180 C. The degree of polymerization was ascertained by extracting the by-product water into ethanol and measuring by gas chromatography, using methanol as an internal standard. The size of the particles of monomeric nylon salt did not affect the rate of the polymerization reaction. Polymerization between particles was negligible. The presence of already-polymerized particles neither increased nor decreased the rate of polymerization of the nylon salt. Dissert. Abstr.

N79-11212 Akron Univ., Ohio.

THE INFLUENCE OF PROCESSING VARIABLES UPON THE PHYSICAL PROPERTIES OF BLOCK COPOLYMERS Ph.D. Thesis

Po-chi Lau 1978 133 p

Avail: Univ. Microfilms Order No. 78-19075

The mechanical properties of block copolymers are affected by (1) the kind of monomer in each constituent block and its molecular weight, (2) the solvent systems from which the polymer film is formed and, (3) the processing conditions. A conventional screw extruder was used to investigate how the physical properties of block copolymers can be changed with processing conditions. The polymers studied include a linear styrene-butadience triblock copolymer and three styrene-butadiene star block copolymers. It was found that the stress-strain properties of extrudates drawn at a high temperature (180 C) can be increased moderately. Screw speed and extrusion temperature have no significant effect on these properties. Dissert. Abstr.

N79-11213 Akron Univ., Ohio.

PEEL MECHANICS AND THE ADHESION OF TRIBLOCK COPOLYMERS Ph.D. Thesis

Gary Ray Hamed 1978 158 p

Avail: Univ. Microfilms Order No. 7819072

The mechanics of peel adhesion were examined in detail from a conservation of energy approach. The work of adhesion was divided into three terms: (1) an equilibrium thermodynamic surface energy dependent on the specific interaction across the interface, (2) an energy loss term due to dissipation in the adhesive as it undergoes a cyclic deformation during peeling and (3) energy dissipation experienced by the stripping member. The last term was calculated theoretically for an elastic-plastic strip. Experiments with Mylar film were found to be in good agreement with the theory. It was possible to separate the contribution of plastic yielding to the total detachment force during a peeling test. The extent of this contribution is shown to depend not only on the mechanical properties of the stripping member, but also on the deformability of the adhesive layer from which it is being peeled. Dissert. Abstr.

N79-11214 State Univ. of New York at Stony Brook.

THE MICROSTRUCTURE OF PLASMA SPRAYED CERAMIC COATINGS Ph.D. Thesis

Volker Hugo Stephan Wilms 1978 244 p

Avail: Univ. Microfilms Order No. 7819123

The microstructure and crystallographic aspects of the coatings were examined using electron microscopy and X-ray diffraction techniques. Alumina and alumina with yttria additions were studied and it was found that the plasma sprayed coating is comprised of platelets, which were splat cooled at rates estimated to be of the order of one million degrees per second. This high cooling yields a variety of metastable structures and interesting grain morphologies. The topography of the surface on which the particles impinge is shown to play a decisive role with respect to the orientation of the grains within each particle. These morphological details are considered in light of models proposed for splat quenching. Implications relative to adhesive strength are discussed. Dissert. Abstr.

N79-11215*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AMBIENT CURE POLYIMIDE FOAMS Patent Application

Paul M. Sawko, Salvatore R. Riccitiello, and Charles L. Hamermesh, inventors (to NASA) (Rockwell Intern., Thousand Oaks, Calif.) Filed 31 Oct. 1978 15 p

(NASA-Case-ARC-11170-1; US-Patent-Appl-SN-956161) Avail: NTIS HC A02/MF A01 CSCL 07D

Flame and temperature resistant polyimide foams are prepared by the reaction of an aromatic dianhydride, (pyromellitic dianhydride) with an aromatic polyisocyanate, (polymethylene polyphenylisocyanate), in the presence of an inorganic acid and furfuryl alcohol. Usable acids include dilute sulfuric acid, dilute nitric acid, hydrochloric acid, polyphosphoric acid, and phosphoric acid, with the latter being preferred. The dianhydride and the isocyanate in about equimolar proportions constitute about 50% of the reaction mixture, the rest being made up with the acid and the alcohol in a ratio of about 1:10. An exothermic reaction between the acid and the alcohol provides the heat necessary for the other components to polymerize without recourse to external heat sources. The mixture can be sprayed on any surface to form polymeric foam in locations where the application of heat is not practical or possible, for instance, between walls or on mine tunnel surfaces. NASA

N79-11216*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MODIFICATION OF THE ELECTRICAL AND OPTICAL PROPERTIES OF POLYMERS Patent Application

M. J. Mirtich and James S. Sovey, inventors (to NASA) Filed 7 Nov. 1978 11 p

(NASA-Case-LEW-13027-1; US-Patent-Appl-SN-958575) Avail: NTIS HC A02/MF A01 CSCL 07C

The surface of a polymer is irradiated to modify the optical and electrical properties as well as to change the surface morphology. A polymer is placed in a vacuum of about 4x 10 to the minus 5th power torr. A surface of the polymer is exposed to a beam of argon ions having an energy between 500 and 1000 eV and an ion beam current density between 0.1 and 1.0 mA/sq cm. The resulting texturing of the surface causes a large decrease in spectral transmittance at all wavelengths. The surface conductivity of the polymer is also increased. The textured surface further enhances the adherence of thin films to the polymer. A polyimide, (Kaptan) and a fluorinated ethylene propylene, (Teflon) are surface treated in accordance with the invention.

NASA

N79-11217# Battelle Columbus Labs., Ohio.

FAST FRACTURE RESISTANCE OF GLASSY POLYMERS AND FIBER COMPOSITES Final Report, 1 Jan. 1975 - 30 Jun. 1978

M. F. Kanninen and A. R. Rosenfield 30 Jun. 1978 9 p refs (Grants DAHC04-75-G-0080; DAAG29-77-G-0119)

(AD-A056505; ARO-11691.4-MS) Avail: NTIS HC A02/MF A01 CSCL 11/2

A summary is given of experiments and analysis involving rapid crack propagation and arrest in wire-reinforced polymer composites. Author (GRA)

N79-11218# Battelle Columbus Labs., Ohio.
CERAMIC-TO-METAL SEALS FOR HIGH POWER MICROWAVE TUBES Final Report
Roy F. Wielonski May 1978 61 p refs
(Contract F33615-76-C-5239)
(AD-A057413; AFML-TR-78-31) Avail: NTIS HC A04/MF A01 CSCL 11/1

The objective of the program was the development of a material process capability for metal-to-ceramic sealing used in high-power cross-field amplifier (CFA) microwave tubes. The specific objective was to develop the ion plating process to deposit multilayered metallic coatings onto the highest purity available beryllium oxide (BeO) and aluminum nitride (AlN) substrate materials. A satisfactory copper/molybdenum-to-beryllia bond was achieved without the use of an active metal adhesion aid such as titanium. An ion plating technique was developed for depositing two-layer films such as molybdenum and copper onto BeO. Subsequent evaluation of this metal-to-ceramic combination indicated a bond strength of over 140.32 Mega Pascal. GRA

N79-11219# Yeshiva Univ., New York. School of Science.
CHARACTERIZATION OF P (L)ZT CERAMICS BY MODULATED OPTIMAL SPECTROSCOPY Final Report, 1 Jan. 1976 - 30 Sep. 1977
S. H. Shin, M. I. Bell, and F. H. Pollak Jul. 1978 55 p
(Contract N00014-76-C-0516)
(AD-A057371) Avail: NTIS HC A04/MF A01 CSCL 20/12

The purpose of this investigation is to study and develop non-destructive, simple, and rapid methods for measuring the structural and dynamic properties of ferroelectric ceramics. Optical modulation techniques, particularly electric field modulated transmission and reflectivity, have been shown to be powerful tools for investigating the electronic properties of solids. By modulating an internal parameter such as electric field (electroreflectance and electrotransmission) it is possible to obtain derivative-like enhancements of optical structures related to interband transitions. In Section 2 characterization of transparent PLZT ceramics by modulated optical spectroscopy and in Section 3 an electroreflectance study of opaque PZT ceramics are presented. GRA

N79-11220# Mechanical Technology, Inc., Latham, N. Y.
A NUMERICAL SOLUTION FOR A GENERALIZED ELLIPTICAL CONTACT OF LAYERED ELASTIC SOLIDS Ph.D. Thesis. Final Report
John A. McCormick May 1978 155 p refs
(Contract N00014-72-C-0083)
(AD-A056232; MTI-78TR52) Avail: NTIS HC A08/MF A01 CSCL 20/11

A numerical method is developed to compute the pressure distribution and normal approach in a generalized elliptical contact between layered linearly elastic solids. The computed quantities are obtained as an approximate solution to an integral equation formulated for the most general case of Hertz's assumptions, i.e., the frictionless contact between arbitrary surfaces whose undeformed normal separation can be approximated by the separation between an elliptical paraboloid and the tangent plane at its vertex. The numerical method is based on a discretized representation of the unknown pressure distribution. The method is applied to the contact between a homogeneous solid and a layered solid consisting of an isotropic surface layer of uniform thickness in perfect adhesian to an isotropic substrate. Comparisons with available solutions for the limiting cases of Hertz contact between homogeneous solids and axisymmetric contact of layered solids establish the accuracy of the numerical method. GRA

N79-11221# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
HEAT TRANSFER MEASUREMENTS OF SAFETY APPAREL FABRICS Final Report
A. M. Stoll, M. A. Chianta, and J. R. Piergallini 25 Jan. 1978 22 p refs
(AD-A057328; NADC-78209-60) Avail: NTIS HC A02/MF A01 CSCL 11/5

Twenty-one fabrics of possible use in thermal protection were submitted for evaluation of their heat transmission characteristics. Measurements of heat transfer were made on exposure of the fabrics to flame contact and to radiation at flux levels of practical interest. The results are summarized in Table 1 and discussed with respect to their use in design of improved thermal protection clothing. Author (GRA)

N79-11222# Battelle Columbus Labs., Ohio.
DETECTION AND CHARACTERIZATION OF WATER-INDUCED REVERSION OF EPOXY AND URETHANE POTTING COMPOUNDS Final Report, 10 Oct. 1976 - 10 Oct. 1977
A. J. Jakobsen May 1978 80 p
(Contract N00019-76-C-0626)
(AD-A057316) Avail: NTIS HC A05/MF A01 CSCL 11/9

Infrared and dielectric measurements have been successfully used to detect changes in epoxy and urethane systems which soften when exposed to moisture and/or temperature. The data from these measurements show correlation with softening of the polymer systems (as determined by hardness measurements) and thus, indicates that the combination of infrared and dielectric measurements may be a sensitive means of detecting reversion in potting compounds. GRA

N79-11223# AiResearch Mfg. Co., Phoenix, Ariz.
CERAMIC TECHNOLOGY READINESS PROGRAM Monthly Technical Progress Report, 3-30 Apr. 1978
10 May 1978 38 p refs
(Contract EF-77-C-01-2664)
(FE-2664-7; MTPR-17) Avail: NTIS HC A03/MF A01

Progress is reported on work performed to (1) provide convincing evidence of the ability of ceramic components to survive for lifetimes adequate for utility applications in an environment of high temperature combustion products from coal derived fuels and, (2) to develop and demonstrate technology readiness for the application of ceramic materials technology to advanced gas turbines operating on coal derived fuels in utility base load and intermediate load service. Author

N79-11224# Uniroyal, Inc., Middlebury, Conn. Oxford Management and Research Center.
SUBSTITUTE FOAMING AGENT FOR THE MANUFACTURE OF PART 572 DUMMY FLESH COMPONENTS Final Report
William P. Whelan, Jr. and Martin I. Jacobs May 1978 220 p refs
(Contract DOT-HS-6-01326)
(PB-283396/0; DOT-HS-803387) Avail: NTIS HC A10/MF A01 CSCL 11I

Flesh formulations were successfully foamed in the laboratory with an agent comprising combination of p, prime-oxybis-(benzene sulfonyl hydrazide) and t-butyl peroxypivalate. The components are available commercially from a variety of domestic suppliers, entail no cost penalty, and present no unusual use hazards. The foams were molded over a suitable, broad thickness range at appropriate densities. Properties were comparable, but not identical, to those of Nitrosan foams, with indicated advantages in resistance to aging and low compression set. The new foams were optimized in structure and physical properties by further formulation development. All requisite dummy skin/flesh parts were produced successfully and reproducibly at a commercial facility with conventional equipment for Nitrosan parts. GRA

N79-11225# National Technical Information Service, Springfield, Va.
HIGH TEMPERATURE LUBRICANTS AND OILS, VOLUME 2. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1977 - Aug. 1978
Diane M. Cavagnaro Sep. 1978 129 p Supersedes NTIS/PS-77/0860; NTIS/PS-76/0759; NTIS/PS-75/600
(NTIS/PS-78/0947/8; NTIS/PS-77/0860; NTIS/PS-76/0759; NTIS/PS-75/600) Avail: NTIS HC $28.00/MF $28.00 CSCL 11H

The bibliography contains Federally-funded research on the composition, properties, testing, and use of high-temperature lubricants, oils, and hydraulic fluids. Greases, solid lubricants, and self-lubricating materials were tested at high temperature. This bibliography contains 123 abstracts, 33 of which are new entries to the previous edition. GRA

N79-11226# National Technical Information Service, Springfield, Va.
HIGH TEMPERATURE LUBRICANTS AND OILS, VOLUME 1. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - 1976
Diane M. Cavagnaro Sep. 1978 176 p
(NTIS/PS-78/0946/0) Avail: NTIS HC $28.00/MF $28.00 CSCL 11H

Federally-funded research on the composition, properties, testing, and use of high temperature lubricants, oils, and hydraulic fluids are cited. Greases, solid lubricants, and self-lubricating materials tested at high temperature are included. This updated bibliography contains 170 abstracts, none of which are new entries to the previous edition. GRA

N79-11227# National Technical Information Service, Springfield, Va.
HIGH TEMPERATURE LUBRICANTS. CITATIONS FROM THE AMERICAN PETROLEUM INSTITUTE DATA BASE Progress Report, 1974 - Jun. 1978
Diane M. Cavagnaro Sep. 1978 171 p
(NTIS/PS-78/0949/4) Avail: NTIS HC $28.00/MF $28.00 CSCL 11H

This bibliography contains research on high temperature lubricants. Composition, properties, testing, uses, performance, and wear ability of hydraulic fluids, oils, greases, and solid lubricants are covered. This bibliography contains 124 abstracts. GRA

N79-11228# National Technical Information Service, Springfield, Va.
HIGH TEMPERATURE LUBRICANTS AND OILS, VOLUME 2. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1975 - Aug. 1978
Diane M. Cavagnaro Sep. 1978 200 p Supersedes NTIS/PS-77/0861; NTIS/PS-76/0761
(NTIS/PS-78/0948/6; NTIS/PS-77/0861; NTIS/PS-76/0761) Avail: NTIS HC $28.00/MF $28.00 CSCL 11H

This bibliography of worldwide research citations discusses the properties, uses, composition, performance, and wearing ability of hydraulic fluids, oils, greases, and solid lubricants. This updated bibliography contains 194 abstracts, 39 of which are new entries to the previous edition. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N79-11229 Delaware Univ., Newark.
MOLECULAR DYNAMICS OF SELECTED SOLID PROPELLANTS Ph.D. Thesis
Frank Goetz 1978 131 p
Avail: Univ. Microfilms Order No. 7818569

The breakdown of the ammonium perchlorate crystal lattice in the 25-350 C temperature range was studied by laser Raman spectroscopy. The onset of essentially unhindered tumbling of the perchlorate anion was found to trigger the lattice decomposition. The effects of crystal lattice dopants were also established on the molecular dynamics. The four polymorphs of octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine were studied under conditions of thermal and pressure stress by Raman spectroscopy. Slow heating, rapid heating, and long term stability, phase transformation diagrams were established, along with the phase transformations under pressure from a diamond anvil cell. Dissert. Abstr.

N79-11230 Cornell Univ., Ithaca, N. Y.
MATHEMATICAL THEORY OF LIQUID FUEL DROPS AND MONOPROPELLANTS USING THE CLAUSIUS-CLAPEYRON RELATION Ph.D. Thesis
Michael Joseph Normandia 1978 180 p
Avail: Univ. Microfilms Order No. 7817872

The burning of fuel drops and the decomposition of monopropellant drops are examined in the limit of large activation energy. The goal is to obtain curves of burning rate, represented by the flux M of fuel at the surface, versus the Damkohler number D, representing either the ambient pressure or droplet radius. Dissert. Abstr.

N79-11231* National Aeronautics and Space Administration. Pasadena Office, Calif.
ELECTROEXPLOSIVE DEVICE Patent
Vincent J. Menichelli, inventor (to NASA) (JPL) Issued 1 Aug. 1978 7 p Filed 8 Nov. 1976 Supersedes N77-17258 (15 - 08, p 1012) Sponsored by NASA
(NASA-Case-NPO-13858-1; NASA-Case-NPO-13859-1; US-Patent-4,103,619; US-Patent-Appl-SN-740153; US-Patent-Class-102-28R) Avail: US Patent Office CSCL 19A

An electroexplosive device is presented which employs a header having contact pins hermetically sealed with glass passing through from a connector end of the header to a cavity filled with a shunt layer of a new nonlinear resistive composition and a heat-sink layer of a new dielectric composition having good thermal conductivity and capacity. The nonlinear resistive layer and the heat-sink layer are prepared from materials by mixing with a low temperature polymerizing resin. The resin is dissolved in a suitable solvent and later evaporated. The resultant solid composite is ground into a powder, press formed into the header and cured (polymerized) at about 250 to 300 F. Official Gazette of the U.S. Patent Office

N79-11232*# Computer Sciences Corp., Bay St. Louis, Miss. Engineering and Science Lab.
SHIELD GROUP 5 SUPPRESSIVE SHIELD PLASTIC LINEAR AND PROPELLANT TESTING Engineering Study, Mar. 1976 - May 1977
W. R. Wilcox Feb. 1978 66 p refs
(Contract NAS13-50; MIPR-8166104601)
(NASA-CR-157817; AD-A056015; AD-E400148; EA-27R1; ARTSD-CR-78001) Avail: NTIS HC A04/MF A01 CSCL 13/12

A prototype Shield Group 5 Suppressive Shield of modular, prefabricated construction suitable for application to illuminant, propellant and pyrotechnics production lines was used. The testing was to evaluate the performance of plastic and steel liners and to increase the safety certifiable liners for the Group 5S/S to 22.7 kg of illuminant, 270 kg of propellant and 1.1 kg of high explosive. Author (GRA)

N79-11233# Army Armament Research and Development Command, Dover, N. J. Technical Support Directorate.
BEYOND THE STATE-OF-THE-ART ILLUMINATION MEASUREMENTS Final Report
C. L. Smith and D. N. Everswick Apr. 1978 32 p
(AD-A056014; AD-E400151; ARTSD-TR-77002) Avail: NTIS HC A03/MF A01 CSCL 17/8

The invention of a direct method of obtaining candlepower has led to the development of a mathematical model of a simplified system for field testing illuminant items. In addition to obtaining the light intensity independent of the source distance, an innovation for assessing the atmospheric transmissivity is described. The light transmission is measured without employing special equipment other than that used for the basic candlepower measurements. The model configuration constraints are based on present field test practice. This technique will allow two or three people to set up and man a complete field test system. Test results which formerly required extensive data reduction and processing will be available on-site for instant readout. Besides increasing the reliability of data and on-the-spot readout, this system should reduce costs and generally enhance illuminant testing. Author (GRA)

N79-11234# Naval Weapons Support Center, Crane, Ind.
DISPOSAL OF NAVY COLORED SMOKE COMPOSITIONS AND IDENTIFICATION OF PRODUCTS OF COMBUSTION Interim Report, 1 Oct. 1976 - 30 Sep. 1977
Clarence W. Gilliam and Carl E. Dinerman 31 May 1978 28 p refs
(AD-A056274; NWSC/CR/RDTR-85) Avail: NTIS HC A03/MF A01 CSCL 19/1

An investigation was conducted to find the most environmentally acceptable and cost effective means of reclaiming or disposing of waste navy colored smoke compositions. It is shown that the number of different kinds of excess smoke devices, the quantity related to the different kinds, cost of reclaim of each kind, and total quantity dictated that a disposal method be developed. The method of disposal chosen was incineration. A stainless steel incinerator with a 2.3 meter pathlength was constructed with a room and high temperature section. The room temperature section is equipped with a thermocouple to allow monitoring of the combustion process from ignition to removal of sublimed dye from the room temperature section for oxidation in the high temperature section. All effluents were collected for gas and condensables analyses. The results were a myriad of organic compounds: aromatics, and high molecular weight alkanes. The composite was 1300 micrograms which is 65 ppm. No polynuclear aromatic compounds were found. Author (GRA)

N79-11235# Naval Surface Weapons Center, Indian Head, Md.
ANALYSIS OF 2, 2', 4, 4', 6, 6'-HEXANITROSTILBENE (HNS) BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY Final Report
Eleonore G. Kayser 14 Mar. 1978 26 p
(AD-A056618; NSWC/WOL/TR-77-154) Avail: NTIS HC A03/MF A01 CSCL 19/1

A high performance liquid chromatographic (HPLC) method for the determination of HNS is described. A reverse-phase micro column was used with a methanol/distilled water mobile phase in a ratio of 2:3 by volume. This method is capable of separating all known by-product impurities resulting from the preparation of HNS by the 'Shipp Process'. Assays of HNS and 2,2:,4,4:,6,6:-Hexanitrobibenzyl (HNBiB), the major impurity, can be obtained in less than 40 minutes. Accurate analyses (+ or - 2%) of HNS and all known by-products can be made in about 90 minutes. Author (GRA)

N79-11236# Los Alamos Scientific Lab., N. Mex.
THERMOCHEMICAL PRODUCTION OF HYDROGEN FROM WATER
K. E. Cox and Melvin G. Bowman 1977 21 p refs Presented at the Workshop on Supply and Demand of Hydrogen as a Chemical Feed Stock, Houston, Tex., 12-14 Dec. 1977
(Contract W-7405-eng-36)
(LA-UR-78-652; Conf-771246-1) Avail: NTIS HC A02/MF A01

After a brief discussion of thermochemical efficiency and step wise decomposition of water, some of the more promising thermochemical hydrogen cycles under investigation are described. (Author) DOE

N79-11237# Mueller Associates, Inc., Baltimore, Md.
DENATURANTS FOR ETHANOL/GASOLINE BLENDS
Apr. 1978 19 p refs
(HCP/M2098-01) Avail: NTIS HC A02/MF A01

A major source of revenue for the Federal Government is the tax placed on ethyl alcohol used for human consumption. If ethyl alcohol (ethanol) is used as an automotive fuel, it will be necessary to deter any potential public damage or attempts at avoiding the taxation of potable ethanol, both of which could occur through uncontrolled distribution of bootleg alcohol products. A study assesses: (1) if the ordinary methods denaturing ethyl alcohol are satisfactory to prevent the recovery of potable ethanol from any future ethanol/gasoline fuel blends; and (2) if there is a need for the development of a more effective denaturant. The effects that any government tax credit programs (designed to encourage the use of alcohol as a gasoline extender) may have on the possible recovery of potable ethanol from ethanol/gasoline fuel blends were considered. DOE

N79-11238# Fluor Engineers and Constructors, Inc., Irvine, Calif.
ECONOMICS OF FUEL GAS FROM COAL: AN UPDATE INCLUDING THE BRITISH GAS CORPORATION'S SLAGGING GASIFIER Final Report
K. Chandra, B. McElmurry, and S. Smelser May 1978 100 p refs
(EPRI Proj. 239)
(EPRI-AF-782) Avail: NTIS HC A05/MF A01

The results of an economic screening study for oxygen blown, slagging, coal gasification process to produce intermediate Btu fuel gas are presented. All of the processes investigated produce fuel gas which could be used in fossil fired power plants. The evaluation was based on a complete grass roots facility sized to conform to electric utility practice of building units of approximately 1000 MW capacity. The conclusion reached is that, within the accuracy of the study, fuel gas costs projected for the moving bed process, using the BGC slagging gasifier, are competitive with costs projected based on fluidized bed and entrained processes. The major assumption underlying the conclusion is that the BGC slagging gasifier operates successfully on a commercial scale in exactly the same manner as is represented by the performance estimates used. DOE

N79-11239# TRW Defense and Space Systems Group, Redondo Beach, Calif. Chemistry and Chemical Engineering Lab.
CATALYTIC CONVERSION OF COAL ENERGY TO HYDROGEN Project Final Report
John A. Starkovich, James D. Pinkerton, and Ethelyn Motley Oct. 1977 154 p refs
(Contract EX-76-C-01-2206)
(FE-2206-14) Avail: NTIS HC A08/MF A01

The catalytic gasification of coal char with the use of alkali salt based catalyst systems for promoting the char-lime-steam, char-steam, and char-oxygen-steam gasification reactions was studied. The activity and recyclability performance of selected alkali catalyst systems were evaluated using both fixed and fluid bed reactors. It was established in both fixed and fluid bed reactor tests that all char gasification reactions could be made to rapidly occur at 650 C with steam using alkali catalysts such as sodium and potassium carbonate. The reaction temperature is approximately 150 to 200 deg lower than the temperature at which rapid reaction can be effected for uncatalyzed char gasification reactions. It was shown in reactions carried out in fluidized bed reactors, that a 95 percent pure hydrogen product is obtainable from catalyzed char-acceptor-steam reactions at 650 C and for 3 to 6 atmosphere reaction pressures. DOE

N79-11240# Department of Energy, Bartlesville, Okla. Research Center.
AVIATION TURBINE FUELS, 1977
Ella Mae Shelton May 1978 15 p refs
(BERC/PPS-78/2) Avail: NTIS HC A02/MF A01

Average values of selected tests of aviation turbine fuels produced during 1977 are compared with data from the 1970-1976 surveys for aviation turbine fuels for grade JP-4 military, Jet B commercial, grade JP-5 military, Jet A commercial, and Jet A-1 commercial fuels. Data for each of the individual analyses are tabulated. DOE

N79-11241# Department of Energy, Washington, D. C. Div. of Solar Energy.
FUELS FROM BIOMASS PROGRAM: PROGRAM SUMMARY
Jan. 1978 104 p
(DOE/ET-0022/1) Avail: NTIS HC A06/MF A01

An overview of the ongoing research, development, and demonstration efforts of the period Oct. 1, 1976 - Sept. 30, 1977 is presented. Accomplishments were highlighted and plans for continued activities are included. The following section headings are discussed: the fuel from biomass program; organizational and functional responsibilities; program funding; fiscal year 1977 summary tables; current projects; production and collection of biomass and conversion of biomass; bibliography; index of contractors; and, appendix-unsolicited proposal requirements. DOE

N79-11242# Department of Energy, Washington, D. C. Alcohol Fuels Program.
ALCOHOL FUELS PROGRAM PLAN
Mar. 1978 59 p
(DOE/US-0001/2) Avail: NTIS HC A04/MF A01

The Department of Energy has considered the production and use of ethanol and methanol as liquid fuels. The task force on alcohol fuels has reviewed the status of alcohol-related activities within DOE and elsewhere and has formulated a plan of action to (1) help resolve uncertainties, and (2) provide options supportive of potential national decisions in this area. DOE is

currently conducting a fuels Supply Strategy Study which will consider all candidate alternative fuels and emphasize contingency planning to ensure an acceptable balance between supply and demand under future contingency cases. The special studies included in the immediate action element will provide analyses of key-issue areas for alcohol fuels to support the fuels supply strategy study. These special studies will examine the following aspects of alcohol fuels use: (1) resource availability, (2) economic, environmental, and social impacts, (3) end-use applications, (4) Federal fiscal consequences,(5) industry incentives, and (6) policy instruments for price control, market assurance, and import control. DOE

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N79-11243 Wisconsin Univ. - Madison.
CRYOGENIC TWO-PHASE FLOW CHARACTERISTICS OF HELIUM 1 IN VERTICAL TUBES Ph.D. Thesis
Adel Khalil Hassan Khalil 1978 322 p
Avail: Univ. Microfilms Order No. 7814269

Experimental and analytical studies are carried out on the two-phase flow phenomena of Helium 1 flowing in the upward direction in smooth tubes. Pressure drops are measured at both adiabatic and diabatic conditions with exit vapor qualities ranging from 0 to 100 percent. The void fraction at the exit of the test section is measured with a capacitance probe connected to a sensitive circuit designed to detect small density changes. Tests are carried out on three 1000 mm long test sections of sizes 6.35, 2.7 and 2.1 mm ID. Data for pressure drop and exit void fraction is obtained at different pressures ranging from 1 to 2 atm, liquid helium flow rates of 5 to 35 l/hr and temperatures of 4.2-5.2 K. An empirical threshold criterion for the inception of the observed density wave oscillations is developed from similarity analysis. Dissert. Abstr.

N79-11244 Vanderbilt Univ., Nashville, Tenn.
AN ITERATIVE APPROACH TO THE NONLINEAR ANALYSIS AND DESIGN OF REINFORCED CONCRETE STRUCTURES Ph.D. Thesis
Mauricio Antonio Gerlein 1978 201 p
Avail: Univ. Microfilms Order No. 7819529

The proposed analysis is based on the stiffness method, and analysis tool familiar to most engineers that employs the cosecant approach in searching for the state of equilibrium. Both simple and complex structures are analyzed using the same techniques. The nonlinear behavior of reinforced concrete structures is modeled by a perfectly rigid-elastic rotational spring placed at locations of peak moments. A rapidly converging iterative approach is utilized in analyzing for any given load level. Thus, either the load history of a structure can be developed, or the response of structure to a particular loading condition can be obtained directly if the load history of the structure is not needed. Due to the large computational effort involved in a nonlinear analysis, a story-by-story linear programming approach is developed to generate a preliminary design. A user-oriented computer code is developed so that the topology of the structure can be defined. Dissert. Abstr.

N79-11245 Texas Univ. at Austin.
DESIGN PROCEDURE FOR ASPHALT CONCRETE OVERLAYS OF FLEXIBLE PAVEMENTS Ph.D. Thesis
John Paul Zaniewski 1978 320 p
Avail: Univ. Microfilms Order No. 7817739

The rationale for each step of the procedure is documented with respect to previous research and new developments. A design manual is presented. Distress functions are developed to use the output from elastic layer theory to predict the occurrence of fatigue cracking and rutting. The basic steps of the design procedure include field evaluation of the existing pavement with condition and deflection surveys, division of the design project into sections with similar characteristics, material sampling and laboratory testing, analysis of the existing pavement to determine remaining life and the subgrade design modulus, development of design curves for rutting and fatigue cracking criteria, and selection of the design thickness. Dissert. Abstr.

N79-11246* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
NOZZLE EXTRACTION PROCESS AND HANDLEMETER FOR MEASURING HANDLE Patent
Vernon L. Alley, Jr. and Austin D. McHatton, inventors (to NASA) Issued 1 Aug. 1978 13 p Filed 19 Oct. 1976 Supersedes N77-10198 (15 - 01, p 0031)
(NASA-Case-LAR-12147-1; US-Patent-4,103,550; US-Patent-Appl-SN-733825; US-Patent-Class-73-159; US-Patent-Class-73-95) Avail: US Patent Office CSCL 13H

Method and apparatus for quantitatively measuring the handle of fabrics and other flexible materials is presented. Handle is that term used to refer to the qualities of drapability, flexibility, compressibility, foldability, stretchability, pliability, etc., possessed by fabrics and other flexible materials. In the present invention the handle of a material sample is quantified by measuring the force required to draw the sample through an orifice and expressing the resultant extractive force as a function of test apparatus geometry and the amount of sample drawn through the orifice to arrive at quantitative measure of handle, to be defined as handle modulus, for the sample in question.
Official Gazette of the U.S. Patent Office

N79-11247# Comptroller General of the United States, Washington, D.C.
GETTING A BETTER UNDERSTANDING OF THE METRIC SYSTEM: IMPLICATIONS IF ADOPTED BY THE UNITED STATES, EXECUTIVE SUMMARY
20 Oct. 1978 88 p
(CED-78-128A; B-140339) Avail: NTIS HC/MF; GAO HC/MF (no charge) from US General Accounting Office, Distribution Section, Room 1518, 441 G Street, NW Washington, D. C. 20548

Metrication was discussed with numerous officials of trade associations, individual companies, Federal and State governments, and other organizations in the various sectors of the U.S. society. Questionaires were mailed to businesses, corporations, governments and agencies and contact was made with a public opinion polling organization to obtain consumer views on the metric system. Relevant legislation and available documents on metrication were reviewed. Metrication was also discussed with officials of Canada and the United Kingdom. Available documents of metrication in Australia, Canada, New Zealand, and the United Kingdom were also reviewed. The advantages and disadvantages of converting to the metric system are debated and the impact of the conversion is discussed. G.Y.

N79-11248# Comptroller General of the United States, Washington, D.C.
GETTING A BETTER UNDERSTANDING OF THE METRIC SYSTEM: IMPLICATIONS IF ADOPTED BY THE UNITED STATES
20 Oct. 1978 743 p
(CED-78-128; B-140339) Avail: NTIS HC/MF; GAO HC/MF (no charge) from US General Accounting Office, Distribution Section, Room 1518, 441 G Street, NW, Washington, D. C. 20548

Additional discussion is presented on converting to the metric system of measurement. This document supplements N79-11247. G.Y.

N79-11249*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
METHOD AND TOOL FOR MACHINING A TRANSVERSE SLOT ABOUT A BORE Patent Application
Manuel A. David-Malig, inventor (to NASA) (United Aircraft Corp., Sunnyvale, Calif.) Filed 17 Oct. 1978 11 p Sponsored by NASA
(NASA-Case-LAR-11855-1; US-Patent-Appl-SN-953314) Avail: NTIS HC A02/MF A01 CSCL 13H

A machining tool is described for cutting transverse slots in solid rocket motor casings. The cutting tool, mounted on a milling machine, is positioned into the bore of a rocket motor by a vertical feed mechanism. The rocket motor, mounted on rotating table is rotated as the cutting head, being tightly held against

shaft by tensioned cable is moved transversely into the wall to cut a slot. Maximum slot depth is reached when the shaft of the tool is in proximity to the wall of the bore. To increase slot depth, machining ends, the cable is slackened and the tool is backed off to allow the insertion of another spacer. The cable is tightened and the steps of cutting, backing off, and adding spacers are repeated until the desired depth of the slot is reached.
NASA

N79-11250# Army Industrial Base Engineering Activity, Rock Island, Ill.
MANUFACTURING METHODS AND TECHNOLOGY PROJECT SUMMARY REPORTS Final Report
Jun. 1978 65 p
(AD-A057361) Avail: NTIS HC A04/MF A01 CSCL 05/1
The Project Summary Report is a compilation of MM and T summary reports prepared by IBEA based on information submitted by DARCOM Major Subordinate Commands and Project Managers. These projects represent the types of efforts that are being conducted under the Army's MM and T Program.
Author (GRA)

N79-11251# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
AN EXPERIMENTAL INVESTIGATION OF WALL EFFECTS ON SUPERCAVITATING HYDROFOILS OF FINITE SPAN M.S. Thesis
Michael Rex Maixner Aug. 1977 214 p refs
(Contract N00014-76-C-0358; SR0090101)
(AD-A056090) Avail: NTIS HC A10/MF A01 CSCL 20/4
A geometrically similar family of three supercavitating hydrofoils was tested in a variable pressure water tunnel. The half-span foils were of elliptical planform; the ratio of foil half-span to tunnel height was 1/4 for the small foil, 1/2 for the medium foil, and 3/4 for the largest foil. The tunnel was of square cross section. Lift, drag, moment, tunnel speed, ambient pressure, and cavity pressure were measured for attack angles from 8 to 21 degrees and a variety of ambient pressure settings cavity length measurements were obtained from photographs. For the small and medium foils, it was sufficient to correct only for the effect on downwash of the images of the trailing vortices. The large foil data, however, required further correction; upon application of the same corrections which were applied to the data for the two smaller foils, the force and moment data for the large foil plotted slightly lower than did the data for the two smaller foils, while the cavity length data for the large foil indicated cavity lengths significantly larger than for either of the theoretical predictions or the cavity length data for the two smaller foils.
GRA

N79-11252# Army Construction Engineering Research Lab., Champaign, Ill.
STEEL FIBERS AS WEB REINFORCEMENT IN REINFORCED CONCRETE
Gilbert R. Williamson Jun. 1978 15 p refs
(AD-A056496) Avail: NTIS HC A02/MF A01 CSCL 11/4
The objective of this investigation was to determine the feasibility of replacing shear reinforcement (stirrups) with randomly distributed steel fibers for the prevention of diagonal tension (shear) failure in full-scale conventionally reinforced concrete beams. The following conclusions are based upon the use of steel fibers with deformed ends (Dramix) to replace stirrups: (1) Steel fibers can be used to replace stirrups in beams with no reduction in the ultimate design moment capacity; (2) Steel fibers increase the shear strength of concrete beams sufficiently to prevent catastrophic diagonal tension failure, while forcing the beam to fail in flexure; (3) ACI Code procedures can be used without modification to design reinforced concrete beams that contain steel fibers as shear reinforcement; (4) Low volume percentages of steel fibers have no effect upon the stiffness of full-scale beams; and (5) Steel fibers present a potentially more economic alternative to the use of stirrups in reinforced concrete design.
GRA

N79-11253# Trinity Coll., Dublin (Ireland). School of Engineering.
FLEXURAL STRENGTH OF REINFORCED MICROCONCRETE IN STATIC AND IMPACT TESTS Final Report, Jun. 1975 - Mar. 1978
T. E. Glynn, M. Z. Al-Salihi, and R. J. Meagher Mar. 1978 63 p refs
(Grant DA-ERO-75-G-030; DA Proj. 1M1-61102-B52-B)
(AD-A057564) Avail: NTIS HC A04/MF A01 CSCL 11/2
The final report on this investigation addresses these objectives: the static resistance of slabs with varying amounts of reinforcement; the development of yield line patterns; the dynamic resistance of the slabs due to impact loading; relationship between static and dynamic deformation of thin slabs; and slab strengthening by composite construction.
GRA

N79-11254# Bendix Corp., Kansas City, Mo.
DRILLING MINIATURE HOLES, PART 1
L. K. Gillespie Jul. 1978 70 p refs 3 Vol.
(Contract EY-76-C-04-0613)
(BDX-613-1-Rev-Pt-1) Avail: NTIS HC A04/MF A01
Miniature components for precision electromechanical mechanisms, such as switches, timers, and actuators, typically require a number of small holes. An initial study of drill geometries and drilling techniques for producing 0.66 mm diameter holes in stainless steel and brass indicates that positional tolerances of 50.8 microns can be maintained. With appropriate drills, a size repeatability of + or - 2.54 microns can be maintained. Centerdrilling is not required if printed circuit board drills are used. Hole quality depends upon the particular combination of feedrate, drilling technique, and drill geometry used. Spindle speed does not affect hole size or location.
DOE

N79-11255# Bendix Corp., Kansas City, Mo.
DRILLING MINIATURE HOLES, PART 2
L. K. Gillespie Jul. 1978 52 p refs 3 Vol.
(Contract EY-76-C-04-0613)
(BDX-613-1786-Rev-Pt-2) Avail: NTIS HC A04/MF A01
An analysis of the strengths and deflection characteristics of the eight drills utilized in this study indicated that the printed circuit board drills and the spiral-flute pivot drills had the most rigid features. This is consistent with the tests of locational and size accuracy. Drills of this size can be fed at feedrates of 25.4 microns per revolution in brass and stainless steel without breaking. Once the drill point starts into the workpiece, the elastic stability of the drill is not a major factor in breakage.
DOE

N79-11256# Bendix Corp., Kansas City, Mo.
DRILLING MINIATURE HOLES, PART 3
L. K. Gillespie Jul. 1978 82 p refs 3 Vol.
(Contract EY-76-C-04-0613)
(BDX-613-1787-Rev-Pt-3) Avail: NTIS HC A05/MF A01
Eight commercial drill designs studied revealed that printed circuit board drills produced better locational and size repeatability than did other drills when center-drilling was not used. Boring holes 1 mm in dia, or less, as a general rule did not improve hole location in brass or stainless steel. Hole locations of patterns of 0.66 mm holes can be maintained within 25.4 microns diametral positional tolerance if setup misalignments can be eliminated. Size tolerances of + or - 3.8 microns can be maintained under some conditions when drilling flat plates. While these levels of precision are possible with existing off-the-shelf drills, they may not be practical in many cases.
DOE

N79-11257# Technical Research Centre of Finland, Espoo. Ship Lab.
STATE-OF-ART REVIEW OF BASIC ICE PROBLEMS FOR A NAVAL ARCHITECT
Kaj Riska and Petri Varsta Nov. 1977 74 p refs
(VTT-SL-2; ISBN-951-38-0557-3) Avail: NTIS HC A04/MF A01
The structure of ice and the initial formation of ice cover are described. The occurrence and classification of ice in the Baltic are reviewed. The mechanical properties of ice, from the viewpoint of a naval architect, are examined from both theoretical and experimental standpoints. The problems of ice-going ships are studied and modeling techniques for ice-breaking and ice cover are discussed.
ESA

N79-11258# National Bureau of Standards, Washington, D. C. National Engineering Lab.
THE NATIONAL MEASUREMENT SYSTEM FOR MASS,

VOLUME AND DENSITY Final Report
Paul E. Pontius, James R. Whetstone, and John A. Simpson May 1978 73 p refs
(PB-283169/1; NBSIR-75-928) Avail: NTIS HC A04/MF A01 CSCL 14B

The history and current status of mass, volume, and density measurements in the United States are discussed as well as the relative role of the National Bureau of Standards in developing a national measurement system. A bibliography is included.GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking.*

N79-11259 Columbia Univ., New York.
THREE-DIMENSIONAL ELASTIC AND ELECTROMAGNETIC WAVES SCATTERING AND DIFFRACTION Ph.D. Thesis
Long-Far Hwang 1978 117 p
Avail: Univ. Microfilms Order No. 7819354

The formal solutions of displacement field to the problem of elastic wave scattering and diffraction due to an infinitely long rigid cylinder embedded in an infinite elastic medium by an impulsive point source was obtained in the integral form. The integrals for the reflected and the diffracted waves both in the shadow zone and in the illuminated zone are evaluated asymptotically for the early time motion by the Residue-Cagniard method and the Saddle-point-Cagniard method. Dissert. Abstr.

N79-11260 Princeton Univ., N. J.
A FIRST ORDER SCATTERING SOLUTION FOR MODELING LUNAR AND TERRESTRIAL SEISMIC CODAS Ph.D. Thesis
Peter Eric Malin 1978 101 p
Avail: Univ. Microfilms Order No. 7818377

Utilizing a first order renormalized scattering theory, seismogram coda envelopes for surface waves propagating in layered elastic media containing volume inhomogeneities are presented. In agreement with lunar and terrestrial coda observations, the computed results show (1) a long signal duration insensitive to source-receiver details; (2) a model dependent frequency of dominant scattering; and (3) an apparent coda group velocity increase with increasing frequency. The lunar seismograms are suggested as examples of cross-section and source effect dominant codas, while terrestrial codas appear to be examples of dissipation and cross-section dominated cases. Dissert. Abstr.

N79-11261 Cornell Univ., Ithaca, N. Y.
SIMULATION OF ATMOSPHERIC RADIO NOISE AND APPLICATION TO MODEM TESTING Ph.D. Thesis
Carlos Tersio CorreaDaSilva 1978 125 p
Avail: Univ. Microfilms Order No. 7817786

Although narrowband atmospheric radio noise is represented by a carrier modulated both in amplitude and phase, the latter characteristic is not taken into consideration by existing hardware simulators. Consequently, the simulated noise has either a constant or a random phase of unknown behavior. Nevertheless, theoretical studies assume the phase to be uniformly distributed and to be slowly varying in time. In order to assuredly generate these proper phase characteristics, this thesis presents a hardware scheme simulating both variables (envelope, phase)by approximating their distributions (rather than their densities). The advantage of this method is that it permits the specification of the time of occurrence of high amplitude pulses without interferring with the amplitude distribution. A hardware scheme is also proposed to accomplish this time control. Dissert. Abstr.

N79-11262 Princeton Univ., N. J.
NARROWBAND DIGITAL SIGNAL PROCESSING Ph.D. Thesis
Frederick Cole Mintzer 1978 137 p
Avail: Univ. Microfilms Order No. 7818380

A new approach is taken to the design of multirate lowpass filters. In this approach design rules are established which control the aliasing error and filter approximation error by proper choice of the implementations' parameters. Examples demonstrate the substantial savings in computation and storage achievable by these structures. This approach is extended to the case of bandpass and bandstop filtering. The more complicated problem of aliasing error control for these structures is investigated and design rules for a new and simple structure are proposed. Examples demonstrate the substantial computational advantage of this structure. A multirate structure is proposed for computing the narrowband spectrum. It is shown that this structure compares well with the other techniques suggested for performing this calculation. The optimizations performed require a reliable estimate for the order of an optimum FIR bandpass digital filter. This estimate is developed through the use of extensive data fitting. The accuracy of this estimate, the use of extensive data fitting. The accuracy of this estimate, usually witnin + or - 4 filter orders is demonstrated. Dissert. Abstr.

N79-11263 Princeton Univ., N. J.
ADAPTIVE DETECTION AND ESTIMATION Ph.D. Thesis
Alain Fogel 1978 166 p
Avail: Univ. Microfilms Order No. 7818334

Two central issues are addressed. One aspect is the investigation of estimates of the signal parameter using various degrees of partial a-priori knowledge when the noise distribution is a member of the exponential family, and the subsequent implementation of the related detectors. In particular, we investigate the simultaneously detection-estimation of renewal processes whose interarrival times are Gamma distributed. The second aspect of the research deals with the determination of a distance between estimators which, in turn, is related to the Chernoff performance bounds associated with the corresponding optimum and suboptimum detectors. Dissert. Abstr.

N79-11264* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
PHASED ARRAY ANTENNA CONTROL Patent
George D. Doland, inventor (to NASA) (Lockheed Electronics Co., Houston, Tex.) Issued 10 Oct. 1978 15 p Filed 3 Feb. 1977 Supersedes N77-19320 (15 - 10, p 1301) Sponsored by NASA
(NASA-Case-MSC-14939-1; US-Patent-4,119,972; US-Patent-Appl-SN-765165; US-Patent-Class-343-844; US-Patent-Class-343-854) Avail: US Patent Office CSCL 09C

Several new and useful improvements in steering and control of phased array antennas having a small number of elements, typically on the order of 5 to 17 elements are provided. Among the improvements are increasing the number of beam steering positions, reducing the possibility of phase transients in signals received or transmitted with the antennas, and increasing control and testing capacity with respect to the antennas.
Official Gazette of the U.S. Patent Office

N79-11265* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SYSTEMS AND METHODS FOR DETERMINING RADIO FREQUENCY INTERFERENCE Patent
Klaus G. Johannsen (Hughes Aircraft Co., Los Angeles, Calif.), Samuel Sabaroff (Hughes Aircraft Co., Los Angeles, Calif.), and Varice F. Henry, inventors (to NASA) Issued 10 Oct. 1978 19 p Filed 28 Oct. 1976 Supersedes N77-12247 (15 - 03, p 0318)
(NASA-Case-GSC-12150-1; US-Patent-4,119,964; US-Patent-Appl-SN-736286; US-Patent-Class-343-17.7; US-Patent-Class-325-4; US-Patent-Class-325-67) Avail: US Patent Office CSCL 20C

The presence, frequency and amplitude of radio frequency interference superimposed on communication links originating from a terrestrial region and including a relay in a geostationary spacecraft are determined by pointing a narrow beam antenna on the satellite at the terrestrial region. The level of noise radiated from the region to the antenna is measured at a terrestrial station that is usually remote from the region. Calibrating radio signals having a plurality of predetermined EIRP's (Effective Isotropic Radiated Power) and frequencies in the spectrum are transmitted from the region through the spacecraft narrow beam antenna

back to the station. At the station, the levels of the received calibrating signals are separately measured for each of the frequency bands and EIRP's.
Official Gazette of the U.S. Patent Office

N79-11266*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ADDENDUM TO PROCEEDINGS OF THE 1978 SYNTHETIC APERTURE RADAR TECHNOLOGY CONFERENCE
1978 111 p refs Conf. held at Las Cruces, N. Mex., 8-10 Mar. 1978 Prepared in cooperation with New Mexico State Univ., Las Cruces
(NASA-TM-79907) Avail: NTIS HC A06/MF A01 CSCL 17I
Various research projects on synthetic aperture radar are reported, including SAR calibration techniques. Slot arrays, sidelobe suppression, and wide swaths on satellite-borne radar were examined. The SAR applied to remote sensing was also considered. For individual titles, see N79-11267 through N79-11271.

N79-11267*# Naval Research Lab., Washington, D. C. Radar Div.
A PERSPECTIVE OF SYNTHETIC APERTURE RADAR FOR REMOTE SENSING
Merrill I. Skolnik *In* NASA. Johnson Space Center Addendum to Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 20 p refs (For primary document see N79-11266 02-32)
Avail: NTIS HC A06/MF A01 CSCL 17I
The characteristics and capabilities of synthetic aperture radar are discussed so as to identify those features particularly unique to SAR. The SAR and Optical images were compared. The SAR is an example of radar that provides more information about a target than simply its location. It is the spatial resolution and imaging capability of SAR that has made its application of interest, especially from spaceborne platforms. However, for maximum utility to remote sensing, it was proposed that other information be extracted from SAR data, such as the cross section with frequency and polarization. J.A.M.

N79-11268*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
AN UNCONVENTIONAL APPROACH TO IMAGING RADAR CALIBRATION
R. G. Fenner, S. C. Reid, and G. G. Schaber (Geol. Surv., Flagstaff, Ariz.) *In its* Addendum to Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 23 p refs (For primary document see N79-11266 02-32)
Avail: NTIS HC A06/MF A01 CSCL 17I
An unconventional approach to imaging radar calibration was considered for the entire system, including the imaging processing as a measurement instrument. The technique made use of a calibrated aircraft scatterometer as a secondary standard to measure the backscatter (sigma zero) of large units of constant roughness. These measured roughness units when viewed by an imaging radar system can be used to provide gray scale level, corresponding to known degrees of roughness. To obtain a calibrated aircraft scatterometer, a homogeneous smooth surface was measured by both the aircraft scatterometer and a sphere calibrated ground system. This provided a measure of the precision and accuracy of the aircraft system. The aircraft system was then used to measure large roughness units in the Death Valley, California area. Transfer of the measured roughness units to radar imagery was demonstrated. J.A.M.

N79-11269*# Hughes Aircraft Co., Culver City, Calif. Dept. of Antennas.
WAVEGUIDE-EXCITED SLOT ARRAYS FOR SYNTHETIC ARRAY RADAR APPLICATIONS
D. E. Bostrom, D. J. Lewis, and F. C. Rupp *In* NASA. Johnson Space Center Addendum to Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 16 p (For primary document see N79-11266 02-32)
Avail: NTIS HC A06/MF A01 CSCL 17I
The basic design considerations for waveguide slottery arrays are reviewed, with emphasis on those design requirements that are most significant to both airborne and spaceborne synthetic array radar (SAR) systems. As an illustration of both design procedures and performance capability of slotted waveguide planar arrays, an L-band planar array was designed, fabricated, and tested. This array has an aperture approximately one meter wide by two meters high and was designed to be a typical submodule of a larger antenna. Measurements of radiation patterns, gain, and VSWR were recorded and are presented, together with the performance characteristics predicted on the basis of theoretical analysis. J.A.M.

N79-11270*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EFFECT OF WEIGHTING ON TIME SIDELOBE SUPPRESSION
Alan DiCenzo *In* NASA. Johnson Space Center Addendum to Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 14 p refs (For primary document see N79-11266 02-32)
(Contract NAS7-100)
Avail: NTIS HC A06/MF A01 CSCL 17I
Weighting simulations in the time domain were considered to shape the time-compressed pulse waveform. The digital input radar data were 32 bit I,Q, and simulated data from a point target, imaged by a Seasat-A type system. Weighting functions tested include stepped-amplitude distributions, (with 1 through 5 steps), and the cosine-squared plus pedestal distribution. Effects treated include mainlobe ratio, signal to noise ratio, and nearest sidelobe suppression. J.A.M.

N79-11271*# California Univ., San Diego, La Jolla. Dept. of Applied Physics and Information Sciences.
MEANS TO ACHIEVE WIDE SWATH WIDTHS IN SYNTHETIC APERTURE SATELLITE BORNE RADARS
Louis J. Cutrona *In* NASA. Johnson Space Center Addendum to Proc. of the 1978 Syn. Aperture Radar Technol. Conf. 1978 21 p refs (For primary document see N79-11266 02-32)
Avail: NTIS HC A06/MF A01 CSCL 17I
The radar range equation including processing gains for pulse compression and synthetic aperture generation was the starting point. System geometry considerations were introduced. For simplicity, flat earth geometry was used, although it was realized that this was not a good model for satellite-borne radars. Next, the constraints were introduced. These included those needed to avoid ambiguities in both range and azimuth, those needed to acheive the desired resolution, and those needed to achieve the desired swath width. J.A.M.

N79-11272*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A REVIEW OF THE STATE OF THE ART IN LARGE SPACEBORNE ANTENNA TECHNOLOGY
C. A. Smith 15 Nov. 1978 64 p refs
(Contract NAS7-100)
(NASA-CR-157389; JPL-Pub-78-88) Avail: NTIS HC A04/MF A01 CSCL 20N
Three classes of antennas (reflectors, lenses, and arrays) are studied with a view toward their use as extremely large space antennas. RF performance characteristics, weight, manufacturing complexity, and cost are discussed for each class. Examples of antennas of each class which were built or analyzed are described to give an appreciation of current and expected industry capability. Multibeam antennas are discussed. General guidelines are given for use of the appropriate class of antenna to meet certain performance requirements, and recommendations are made for future study. The reflector emerges as the optimum choice for most very large aperture applications, though the lens and array appear ideally suited for use as feeds for multibeam near-field Cassegrain or Gregorian designs. Author

N79-11273# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PRELIMINARY STUDY OF A NETWORK OF SATELLITE COMMUNICATION LINKS [ESTUDO PRELIMINAR DOS ENLACES DE UMA REDE DE COMUNICACOES POR SATELITE]
Aydano Barreto Carleial and Janio Kono Aug. 1978 51 p refs In PORTUGUESE; ENGLISH summary
(INPE-1348-NTE/130) Avail: NTIS HC A04/MF A01
A method is presented for the calculation of SCPC satellite links and results of its application to a communication network with low-capacity and medium-capacity earth stations. A preliminary study is made of two modulation systems for the transmission of voice, telegraphy and data. The main objective

is providing information for the technological development of earth stations. Author

N79-11274# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE EVAPORATION DUCT AND ITS IMPLICATIONS FOR LOW-ALTITUDE PROPAGATION AT KWAJALEIN
J. J. Gerald McCue 11 May 1978 102 p refs
(Contract F19628-78-C-0002; DA Proj. 8X3-63304-D-215)
(AD-A057117; TN-1978-6; ESD-TR-78-83) Avail: NTIS HC A06/MF A01 CSCL 20/14

The principal intent is to provide a basis for understanding the influence of the evaporation duct, a low region of strong refraction existing nearly all the time on the open sea, with varying thickness. There is a survey of the literature, followed by application of published data to the task of estimating the effect of the evaporation duct on the performance of the radars at Kwajalein when the target height is only a few meters. It is concluded that this duct has negligible effect at VHF, UHF, and L band, that at times it causes a large extension of the coverage of the S-band radar, and that it very importantly extends the range of the C-band radar on targets at heights such as 5 meters. Attention is given to the effects of the duct on signal velocity, pulse compression, and polarization ratio. There is also a discussion of the effect of the atmosphere over tropical ocean on the location of the radio horizon for frequencies that are too low to be influenced by the evaporation duct. Author (GRA)

N79-11275# Army Electronics Technology and Devices Lab., Fort Monmouth, N. J.
SILICON WAVEGUIDE LINE SCANNING ANTENNA FOR MILLIMETER WAVES
Kenneth L. Klohn, Robert E. Horn, Elmer Freibergs and Harold Jacobs Jun. 1978 15 p refs
(AD-A056456) Avail: NTIS HC A02/MF A01 CSCL 17/9

Recent demands for a very high resolution radar in terminal homing for missiles and shells and for radar surveillance in general, have generated a need for developing new concepts in low cost millimeter wave antennas. A means of providing electronic line scanning rather than mechanical scanning is desirable in order to reduce system complexity and high cost. It is especially important to eliminate the use of gimbals to mechanically scan an antenna, since they are expensive and slow. This paper describes the design and experimental findings of a novel approach for a side-looking electronic line scanner consisting of a dielectric (silicon) rectangular rod with periodic perturbations on one side. Angular scan is achieved by varying the frequency while the actual numerical values of the scan angles are a function of operating frequency, waveguide size (height and width) and perturbation spacing. An alternative approach was explored where the frequency was held fixed and the effective guide wavelength was varied electronically by modulating the conductivity of a PIN diode mounted on the dielectric waveguide. Antennas were designed for the n = -1 spacial harmonic at operating frequencies in the 55 to 100 GHZ range. GRA

N79-11276# SRI International Corp., Menlo Park, Calif.
A SEARCH BY RADAR BACKSCATTER, FOR IRREGULARITIES PRODUCED BY THE LAGOPEDO F-REGION ELECTRON DEPLETION RELEASES Final Report, 1 Jun. - 31 Dec. 1977
Walter G. Chestnut, George N. Oetzel, and Archibald McKinley Feb. 1978 29 p refs
(Contract DNA001-77-C-0267; SRI Proj. 6440)
(AD-A056385; AD-E300269; DNA-4537F) Avail: NTIS HC A03/MF A01 CSCL 04/1

During early September 1977, the Los Alamos Scientific Laboratory launched two rockets bearing the explosive nitromethane into the F-region over Kauai in the Hawaiian Island chain. The detonation of this material produced a large, generally spherically shaped, reduction in the F-region electron density centered at altitudes between 265 and 285 km. The experiment was called Operation Lagopedo. Some plasma theoreticians had expected that the edges of this electron-depleted region would become unstable by the gradient drift instability process, leading to the generation of magnetic-field-aligned irregularities similar to those produced in the equatorial ionosphere. The naturally produced equatorial irregularities, called spread-F, are regularly detected by magnetic-field-aligned backscatter radar echoes at HF. Therefore, an attempt was made by SRI International to detect the presence of irregularities in the Lagopedo ionospheric hole by the same HF backscatter means. This report describes the SRI experimental program. The SRI HF radar was capable of detecting field-aligned irregularities with spatial wavelengths between (approximately) 5 and 10 m (16 MHz to 32 MHz radar frequencies). System sensitivity was a factor of 200 to 800 times more sensitive than equatorial equipment used at comparable frequencies. An additional 20 dB of Doppler processing can be achieved during post-mission data reduction if necessary. The magnetic orthogonality condition was met in the vicinity of the Lagopedo electron depletion regions, yet no field-aligned echoes wdre observed. GRA

N79-11277# Naval Underwater Systems Center, New London, Conn. Dept. of Special Projects.
CONFIDENCE BOUNDS FOR MAGNITUDE-SQUARED COHERENCE ESTIMATES
G. Clifford Carter and Everett H. Scannell, Jr. 13 Jul. 1978 12 p refs Presented at the IEEE Intern. Conf. on Acoustics, Speech, and Signal Process., Tulsa, Okla., 1978
(AD-A057408; NUSC-TD-5881) Avail: NTIS HC A02/MF A01 CSCL 20/14

The main emphasis of the talk was on explaining coherence and its usefulness. The paper given in the coherence record emphasizes how to estimate coherence and how accurately this can be done. In underwater acoustics where signals are digitally processed at the outputs of two or more receiving sensors, it is desirable to estimate the coherence spectrum, both for detection and position estimation. A processing technique for computing arbitrary confidence bounds for stationary Gaussian signals is presented. Now computationally difficult examples are given for 80-95 percent confidence with independent averages of 8, 16, 32, 64, and 128. A discussion of the computational difficulties together with algorithmic details (including the FORTRAN program) are presented. GRA

N79-11278# Westinghouse Defense and Electronic Systems Center, Baltimore, Md. Command and Control Div.
A STUDY OF A SELF HEALING RADAR SIGNAL PROCESSOR Final Report
P. K. DeGonia, R. C. Witt, D. R. Lampe, and E. L. Cole, Jr. 14 Apr. 1978 114 p
(Contract N00173-77-C-0213)
(AD-A056255) Avail: NTIS HC A06/MF A01 CSCL 09/2

A self-healing radar signal processor was developed using a distributed network architecture. Single chip microcomputers were used as the processing elements in the development of the network. Reliability, communications, FIT/Reconfiguration, and functional partitioning were studied. Author (GRA)

N79-11279# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
NETWORK OPERATING SYSTEMS Final Technical Report, Nov. 1976 - Mar. 1978
Robert H. Thomas, Richard E. Schantz, and Harry C. Forsdick May 1978 339 p refs
(Contract F30602-76-C-0425)
(AD-A056078; RADC-TR-78-117) Avail: NTIS HC A15/MF A01 CSCL 09/2

Netwvrk operating systems represent a promising approach for realizing the full potential of computer communication networks. A network operating system (NOS) is a collection of software and protocols that allow a set of autonomous computers, which are interconnected by a computer network, to be used together in a convenient and cost effective manner. This report investigates some of the technical problems posed by an NOS by describing and comparing five NOS designs. The system designs considered are: a system for automated terminal access and file transfer (ATF); the Resource Sharing Executive (RSEXEC); the National Software Works (NSW) System; the Efficient Local Access Network (ELAN) System; and the Personal Computer ELAN (PC-ELAN) System. The PC-ELAN System is an NOS designed to support the requirements of collections of personal computers. Author (GRA)

N79-11280# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
ASSESSMENT OF PROCESSES RELATED TO PLASMA IRREGULARITIES Final Report, 15 May - 31 Dec. 1977

J. B. Chadis, L. L. Newkirk, G. T. Davidson, W. E. Francis, and M. Walt 31 Dec. 1977 75 p refs
(Contract DNA001-77-C-0207)
(AD-A056250; AD-E300258; DNA-4473F) Avail: NTIS HC A04/MF A01 CSCL 04/1

The occurrence of plasma irregularities that affect radio-wave propagation is assessed both for naturally-occurring disturbances and for disturbances resulting from a high-altitude nuclear explosion. Data obtained with the S3-3 satellite reveal that high electrostatic potential differences - to 8 kV - with associated plasma irregularities, often occur along the magnetic field at high latitudes. In a detailed analysis of electron and ion pitch-angle and energy distributions measured on the satellite, the potential differences below and above the satellite, and the potential distribution above the satellite, were determined. The properties of the potential structure, together with concurrent observations of electrostatic waves, indicate that the potential is supported by anomalous resistivity. Analysis of the wideband data reveals that the scintillation activity has a spatial structure and occurrence similar to those of discrete auroral arcs and electric fields. The general morphology of the scintillations at high latitudes is described, and some interpretations of the data are suggested. The electric fields and currents induced by the debris plasma and fission beta-decay electrons in the magnetosphere due to a high-altitude nuclear explosion are estimated. For large bursts, the currents, both along and across the magnetic field, exceed well-established plasma-instability criteria, resulting in the formation of plasma irregularities. The region over which they are expected to occur extends as much as 60 deg in longitude east of the burst and, north of the burst, to latitudes near the auroral zone. Author (GRA)

N79-11281# Rome Air Development Center, Griffiss AFB, N.Y.
A UHF/EHF HYBRID ANTENNA
John A. Strom, R. J. Mailloux, and L. F. Dennett Mar. 1978 69 p
(AD-A057281; RADC-TR-78-79) Avail: NTIS HC A04/MF A01 CSCL 09/5

This study describes the development and experimental demonstration of the RF feasibility of combining a UHF antenna with an EHF paraboloid. The combination is to provide dual frequency band operation for air-to-satellite communication links. A complete set of gain tables and radiation patterns are presented for a UHF crossed-dipole positioned in the aperture of two different EHF paraboloids. An analysis of the resultant blockage is described and theoretical radiation patterns are calculated and compared with the experimental results. Fuselage simulation experiments are also included. Author (GRA)

N79-11282# Syracuse Univ., N. Y. Dept. of Electrical Engineering.
RAY STRUCTURE OF DUCTED MULTIPATH FOR AN LOS LINK
R. H. Lang May 1978 41 p refs
(Contract F30602-75-C-0121)
(AD-A055994; RADC-TR-78-123) Avail: NTIS HC A03/MF A01 CSCL 20/14

This report describes the geometric optic analysis of a duct model for line-of-sight (LOS) fading. The atmospheric refractive index is molded by three linear segments so as to form an elevated duct. The earth's curvature is taken into account by using the modified refractive index. Simple approximate formula are developed for the number of geometric-optic rays received for a given link length. In addition, the angle of departure from the transmitter of these rays is calculated. The angles enable one to readily calculate the amplitude and phase of contributing rays. To gain insight into the structure of the ray families, the trajectories of trapped rays are plotted. We have found that two cusps exist, each cusp having two caustics associated with it. Author (GRA)

N79-11283# Armament Development and Test Center, Eglin AFB, Fla.
RADAR CROSS SECTION MEASUREMENTS OF THE IMPROVED BQM-34A COLLOCATED AUGMENTATION SCORING SYSTEM Final Test Report, Sep. - Oct. 1977
M. R. Smith Jan. 1978 479 p
(AD-A056616; ADTC-TR-75-64-Vol-3) Avail: NTIS HC A21/MF A01 CSCL 17/9

Data were acquired to define the I-band radar cross section and glint characteristics of the Improved BQM-34A CAS (target drone equipped with Collocated active radar Augmentation Scoring System). Monostatic and bistatic radar measurements were made on a flight worthy BQM-34A. This report provides a summary of the measurement conditions and reproductions of test plots obtained. Also included are reproductions of the antenna gain patterns associated with the digidops scoring system used with the BQM-34A target system. GRA

N79-11284# Telephonics, Huntington, N.Y.
RECOMMENDED DESIGN APPROACH OF GENERAL PURPOSE MULTIPLEX SYSTEM (GPMS) ADVANCED DEVELOPMENT MODEL, PHASE 1
1977 151 p refs
(Contract N62269-76-C-0394)
(AD-A056179) Avail: NTIS HC A08/MF A01 CSCL 17/2

This document describes the design approach for the Advanced Development Model of the GPMS Multiplex Terminal (MT). It summarizes and describes the results of the System Definition Phase (Phase A) of the job and represents the information presented and the decisions agreed to at the Design Briefing. GRA

N79-11285# Logicon, Inc., San Diego, Calif.
LISTEN: A SYSTEM FOR RECOGNIZING CONNECTED SPEECH OVER SMALL, FIXED VOCABULARIES, IN REAL TIME Final Report, Jul. 1977 - Mar. 1978
J. E. Porter Apr. 1978 104 p refs
(Contract N61339-77-C-0096)
(AD-A056231; NAVTRAEQUIPC-77-C-0096-1) Avail: NTIS HC A06/MF A01 CSCL 09/2

This report describes the development of a system for recognizing connected speech in real time using a commercially available speech preprocessor, a minicomputer and programs written in FORTRAN. The system was tested on two speakers using the digits and the word 'point' with inconclusive results. Recognition accuracy of 86% was achieved for one speaker whereas accuracy for the other speaker was lower (39%) due to an anomalous difference between training and test data for that speaker's voice. Author (GRA)

N79-11286# Hochschule der Bundeswehr, Munich. (West Germany). Dept. of Electrical Engineering.
MOBA: RECEIVING SYSTEM WITH HIGH AVAILABILITY Final Technical Report, 1 Apr. 1977 - 31 Mar. 1978
Gerhard Flachenecker May 1978 91 p refs
(Grant DA-ERO-77-G-049; DA Proj. 1T1-61102-B-H57)
(AD-A057344) Avail: NTIS HC A05/MF A01 CSCL 17/2

To investigate fading effects of mobile receiving systems under MOBA-conditions, 6 antennas have been mounted in various spacings on a car and the covariance function of 9 different antenna combinations has been measured in the frequency range 30 to 300 MHz while driving the car. While in nearly all cases the presence of the conducting surface of the car increases correlation over the theoretically expected values, the correlation factors are small enough for sufficient diversity gain above 30 MHz. An experimental receiver for the FM-broadcasting range has been developed for experimental use at the U.S. Army Electronics Research and Development Command. Author (GRA)

N79-11287# California Univ., Los Angeles. Dept. of System Science.
CODING AND MODULATION FOR COMMUNICATION CHANNELS WITH MEMORY Technical Report, Mar. 1977 - Mar. 1978
Ezio Biglieri Mar. 1978 137 p
(Contract N00014-76-C-0875)
(AD-A057375; UCLA-ENG-7829) Avail: NTIS HC A07/MF A01 CSCL 17/2

Linear and nonlinear digital communication channels with memory are considered, with the goal of providing a number of general tools for the analysis and design of coding and modulation schemes operating on such channels. Author (GRA)

N79-11288# Harry Diamond Labs., Adelphi, Md.
EMP ANALYSIS OF AN FM COMMUNICATIONS RADIO

WITH A LONG-WIRE ANTENNA
Werner J. Stark and George H. Baker Jun. 1978 39 p refs (AD-A057702; HDL-TR-1846) Avail: NTIS HC A03/MF A01 CSCL 09/5

A Norton equivalent circuit is developed for a long-wire antenna used with a man-pack FM radio exposed to an incident electromagnetic pulse (EMP). The required short-circuit current and antenna impedance are computed by use of a transmission-line model for the antenna, and the computations are compared with measurements of the short-circuit current and antenna impedance. The comparison shows that the transmission-line model for the antenna is adequate for performing a vulnerability analysis of the radio. A network model is developed for a portion of the radio and is used as the load in the Norton equivalent circuit. Load currents in response to an incident electromagnetic pulse from the Army EMP Simulator Operation (AESOP) are computed when the radio is tuned to specific frequencies in the low and high bands. The computed load currents are compared with experiment and show excellent agreement between theory and experiment. Author (GRA)

N79-11289# Ohio State Univ., Columbus. Electroscience Lab.
NEAR FIELDS OF A VECTOR ELECTRIC LINE SOURCE NEAR THE EDGE OF A WEDGE
D. M. Pozar and E. H. Newman Jun. 1978 21 p refs
(Grant DAAG29-76-G-0331)
(AD-A057403; ESL-784569-5; ARO-14012.2-EL) Avail: NTIS HC A02/MF A01 CSCL 20/3

Simple, closed form expressions are obtained for the fields of an electric line source with transverse or longitudinal current flow, parallel to and near the edge of a perfectly conducting wedge. The effect of an edge which is not perfectly sharp is investigated by considering a cylinder-tipped half-plane. Author (GRA)

N79-11290# Naval Research Lab., Washington, D. C.
ELF NOISE OBSERVED IN THE VICINITY OF LARGE JET AIRCRAFT Interim Report
Joseph A. Goldstein and Robert J. Dinger Dec. 1977 33 p refs
(MIPR-FY-76-19600-06)
(AD-A057685; AD-E000178; NRL-MR-3663) Avail: NTIS HC A03/MF A01 CSCL 20/14

Measurements were made of the electromagnetic fields generated by a KC-135 aircraft in a frequency range of 20 to 200 Hz. The measurements were made using an array of four parallel plate electric field antennas and one ferrite-core magnetic field antenna placed on and near the aircraft; the noise was measured during powering of the engines to as high as 90% of full power while the aircraft was held in place on the ground. The measured noise was complex and difficult to interpret but could be divided into two parts, one arising from various electrostatic sources and the other from vibrations of the antenna on the airframe. The peak electrostatic noise component varied between -35 dB relative to 1 v/m square root of (Hz)(dBE) and -10 dBE, depending on antenna location. These amplitudes are 40 dB to 65 dB greater than typical atmospheric noise. The largest vibration-related component was -8 dBE. The vibration related noise probably is caused by variations in capacitance between the antenna and the airframe due to vibration of the mounting rather than vibrations within the antenna. Aircraft-generated noise of these magnitudes will make reception of the transmitted ELF signal difficult at all ranges from the transmitter. Author (GRA)

N79-11291# Strategic Air Command, Offutt AFB, Nebr. Aircraft Engineering Div.
GIANT IMAGE 2 RELIABILITY AND MAINTAINABILITY B-52D
James H. Harrington 10 Jul. 1978 27 p
(AD-A057938; SAC/LGME-ER-P-313) Avail: NTIS HC A03/MF A01 CSCL 17/9

This report provides a subjective assessment of the logistics supportability of the AN/ALR-46(V)-3 (commonly referred to as ALR46A) radar warning receiver during and following the Giant Image 2 Qualification Operational Test and Evaluation in a B-52D. GRA

N79-11292# Syracuse Univ., N. Y. Dept. of Electrical and Computer Engineering.
ELECTROMAGNETIC TRANSMISSION THROUGH A FILLED SLIT IN A CONDUCTING PLANE OF FINITE THICKNESS, TE CASE Interim Report
D. T. Auckland and R. F. Harrington Griffiss AFB, N. Y. RADC Jul. 1978 92 p refs
(Contract F30602-75-C-0121; AF Proj. 2338)
(AD-A057879; RADC-TR-78-159) Avail: NTIS HC /MF A01 CSCL 20/14

A solution is developed for computing the transmission characteristics of a slit in a conducting screen of finite thickness placed between two different media. The slit may be filled with glossy material while the two regions on either side of the screen are assumed lossless. A magnetic line source excitation is used (TE case) which is parallel to the axis of the slit. The equivalence principle is invoked to replace the two slit faces by equivalent magnetic current sheets on perfect electric conductors. Two coupled integral equations containing the magnetic currents as unknowns are then obtained and solved for by the method of moments. Pulses are used for the expansion and testing functions. Quantities computed are the equivalent magnetic currents, the transmission coefficient, the gain pattern, and normalized far field pattern. The computer program is described and listed along with sample input-output data. Author (GRA)

N79-11293# Pacific-Sierra Research Corp., Santa Monica, Calif.
PROPAGATION OF THE LOW FREQUENCY GROUNDWAVE OVER NONUNIFORM TERRAIN Final Report, 15 Mar. - 30 Sep. 1978
E. C. Field and R. Allen Mar. 1978 61 p refs
(Contract F19628-77-C-0120)
(AD-A057273; PSR-77; RADC-TR-78-68) Avail: NTIS HC A04/MF A01 CSCL 20/14

This report examines the utility and limitations of the integral-equation representation of ground-wave propagation over nonuniform terrain. Emphasis is on frequencies between 20 kHz and 200 kHz. The one-dimensional version of the integral groundwave equation is subject to errors caused by: topographic irregularities near the great-circle propagation path; finite ground conductivity; nonuniformities in the earth's electrical properties; and an approximate integration to reduce the dimension of the equation from two to one. Each of these errors is quantified, and the types of terrain to which the integral ground-wave equation is applicable are defined. A method of numerical solution is developed and used to obtain results for the special case of a smooth, uniform, spherical earth. These results are compared in detail with numerical results obtained from the widely used residue-series representation of ground-wave propagation. The agreement between the two methods is shown to be excellent. Graphical results are given for the ground-wave attenuation function. Author (GRA)

N79-11294# R and D Associates, Marina Del Rey, Calif.
LIQUEFIED NATURAL GAS WIND TUNNEL SIMULATION AND INSTRUMENTATION ASSESSMENTS
Apr. 1978 366 p refs Prepared in cooperation with Colorado State Univ., Fort Collins
(Contract EE-77-C-03-1364)
(SAN-W1364-01) Avail: NTIS HC A16/MF A01

An evaluation of selected aspects of Liquefied Natural Gas safety research is presented. Findings are reported on Liquefied Natural Gas flame radiation data, criteria for test site selection, wind tunnel modeling, wind tunnel tests, instrumentation, and Salton Sea meteorological data. Recommendations are made for methods of studying Liquefied Natural Gas vapor dispersion. DOE

N79-11295# Los Alamos Scientific Lab., N. Mex.
MICROPROCESSOR-CONTROLLED CAMAC DATA LINK MODULE
Jerry M. Potter May 1978 40 p
(Contract W-7405-eng-36)
(LA-7299-M) Avail: NTIS HC A03/MF A01

Communication between the central control computer and remote, satellite data acquisition/control stations at the Clinton P. Anderson Meson Physics Facility (LAMPF) is accomplished through the use of CAMAC-based Data link modules. With the

advent of the microprocessor, a philosophy for digital data communications was evolved. Data link modules containing microprocessor controllers provide link management and communication network protocol through algorithms executed in the Data link microprocessor. DOE

N79-11296# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
INVESTIGATIONS ON AN EXPERIMENTAL ANTENNA ARRAY WITH ADAPTIVE INTERFERENCE SUPPRESSION [UNTERSUCHUNGEN AN EINER EXPERIMENTAL-ANTENNENGRUPPE MIT ADAPTIVER BEWERTUNG ZUR STOERUNTERDRUECKUNG]
G. Ries and W. Soentgerath Aug. 1977 29 p refs In GERMAN; ENGLISH summary
(Contract BMVg-GF-75/76)
(Rept-4-77) Avail: NTIS HC A03/MF A01

Some experimental results of an adaptive 2.4 GHz receiving array antenna for interference suppression are presented. Besides the sum channel with weighting of the seven array elements for maximal array directivity in signal direction, there are six difference channels with weighting by IF control loops, adaptive to the spatial interference distribution. Because of tolerances and limited dynamic range of components, the theoretically excellent interference suppression is not achievable. The experiments show values of 20 dB for one interference source in various directions. Author (ESA)

N79-11297# Eurosat S.A., Geneva (Switzerland).
FUTURE PROSPECTS OF DIGITAL COMMUNICATION SERVICES BY SATELLITE, VOLUME 1
Paris ESA Mar. 1978 210 p refs Prepared jointly with Eurospace, Paris
(Contract ESA-2985/76-F-HS)
(ESA-CR(P)-1062-Vol-1) Avail: NTIS HC A10/MF A01

Existing satellite and terrestrial telecommunication systems and digital communication and data transmission networks are reviewed. Specialized communication services such as teleconferencing, broadcasting, tele-education, computer to computer exchange, data base systems, electronic mail, medical applications, reservation systems, crime, and electronic fund transfer are discussed in detail. Results from a survey in Europe on present day trends and potential requirements are presented. It is concluded that for the moment in most cases data transmission services cannot be multiplexed except through telephone trunk lines and that the quantity of traffic for new digital services will remain very negligible, at least up to 1985. ESA

N79-11298# Eurosat S.A., Geneva (Switzerland).
FUTURE PROSPECTS OF DIGITAL COMMUNICATION SERVICES BY SATELLITE: VOLUME 2: ANNEXES
Paris ESA Mar. 1978 94 p Prepared jointly with Eurospace, Paris
(Contract ESA-2985/76-F-HS)
(ESA-CR(P)-1062-Vol-2) Avail: NTIS HC A05/MF A01

Annexes to volume I of the report are presented. Topics include the American Satellite Business Systems, international, telecommunication standards, forecasting methodology applied to user demand, cost relationship between satellite and terrestrial systems, and satellite ground stations. ESA

N79-11299# European Space Agency, Paris (France).
VERY LONG BASELINE RADIO INTERFEROMETRY USING A GEOSTATIONARY SATELLITE. A MISSION DEFINITION STUDY
28 Apr. 1978 79 p refs
(ESA-DP/PS(78)-15) Avail: NTIS HC A05/MF A01

The application of a geostationary satellite in Very Long Baseline Interferometry (VLBI) is proposed. The rationale and the methodology of the development of a satellite-linked VLBI system in Europe is discussed. Scientific objectives of VLBI in the fields of astrophysics, geophysics, and astrometry are presented. The space segment, including use of satellite link 1-clock synchronization and use of satellite link 2-wideband signal transmission, is dealt with. Ground segment elements discussed include radio observatories, ground stations, water vapor radiometry, data processing center for a European VLBI system and off-line software. ESA

N79-11300# European Space Agency, Paris (France).
HETERODYNE RECEPTION IN THE OPTICAL AND IR FREQUENCY RANGE WITH VARIOUS AMPLITUDE DISTRIBUTIONS
F. Malota Jun. 1978 33 p refs Transl. into ENGLISH of 'Heterodyne-Empfang im opt. u. IR-Frequenzbereich mit verschiedenen Amplitudenverteilungen', DFVLR, Oberpfaffenhofen, West Ger. Report DLR-IB-551-78/2, Feb. 1978
(ESA-TT-490; DLR-IB-551-78/2) Avail: NTIS HC A03/MF A01

In connection with heterodyne reception the signal to noise ratio (SNR) for various combinations of amplitude distributions were calculated. The dependence of the SNR on the incidence angle is given. It is shown that the superposition of two diffraction waves, which originate in the focussing of plane waves, shows the most favorable SNR. Author (ESA)

N79-11301# European Space Agency, Paris (France).
SYNTHETIC APERTURE RADAR (SAR) SYSTEM LIMITATIONS DUE TO PHASE ERRORS
C. Boesswetter Sep. 1978 43 p refs Transl. into ENGLISH of 'Systembegrenzungen durch Phasenfahler beim Radar mit Synthetischer Apertur (SAR)', DFVLR, Oberpfaffenhofen, West Ger. Report DLR-IB-551-77/2, 1 Jan. 1977 Orignal report in GERMAN previously announced as N78-31349
(ESA-TT-481; DLR-IB-551-77/2) Avail: NTIS HC A03/MF A01

The performance of high and very high resolution radar systems with synthetic apertures (SAR) is primarily limited by low and high frequency phase errors along the synthetic aperture. Causes of phase errors and the effects they exert on the behavior of the system are reviewed. Given the dominant importance of the quadratic phase error components as factors that limit the attainable resolution, all subsequent considerations are concentrated on this part of the phase errors. An attempt was made to obtain a direct estimate of the loss of resolution due to acceleration and velocity errors rather than an exact calculation of the pulse response in azimuth. Both aircraft and satellites are assumed as carrier platforms for this purpose. The numerical evaluation of the deduced relationships shows that aircraft-mounted SAR systems of high resolution and great range are very clearly limited by quadratic phase errors. Satellite-mounted SAR systems of the planned type, however, are in no way limited by phase errors because the proposed resolutions remain far below the existing limiting values. But this problem will become of increasing importance in the course of future development with its trend towards satellite-borne systems with ever higher resolutions. Author (ESA)

N79-11302# Naples Univ. (Italy). Lab. di Onde Elettromagnetiche.
POLARIZATION PROPERTIES OF EDGE LOADED HIGH GAIN REFLECTOR ANTENNAS, VOLUME 1 Final Report
O. M. Bucci, P. Corona, G. diMassa, G. Franceschetti, G. Pinto, and C. Savarese Paris ESA [1978] 111 p refs 2 Vol.
(Contract ESTEC-2893/76-NL-AK)
(ESA-CR(P)-1094-Vol-1) Avail: NTIS HC A06/MF A01

A general theory of reflector antennas loaded by surface impedances is presented. The theory was checked experimentally on surface loaded square plate scatterers and then applied to computation of the radiation diagram of parabolic and hyperbolic dishes. Although computer programs and computed diagrams refer to the case of focal illumination, the theory is able to handle the case of offset illumination. Spatial variation of primary illumination was taken into account using either the slope diffraction coefficient or a convolutional approach. The relationship between the two computational techniques is outlined. Discussions on a generalization of the Pauli-Clemmow steepest descent method, diffraction coefficient for the case of oblique incidence, asymptotic evaluation of the diffraction integral for the case of nonuniform illumination, and scattering measurements on loaded metal planes are annexed. Author (ESA)

N79-11303# Naples Univ. (Italy). Lab. di Onde Elettromagnetiche.
POLARIZATION PROPERTIES OF EDGE LOADED HIGH GAIN REFLECTOR ANTENNAS. VOLUME 2: MANUAL FOR GTDLAC PROGRAMS Final Report

G. diMassa and C. Savarese Paris ESA [1978] 43 p refs 2 Vol.
(Contract ESTEC-2893/76-NL-AK)
(ESA-CR(P)-1094-Vol-2) Avail: NTIS HC A03/MF A01

The user manual for two numerical programs for the computation of radiation diagrams of rim loaded parabolic and hyperbolic dishes with focal illumination is presented. The geometrical theory of diffraction (GTD) was used for the computation. The programming language is FORTRAN 4 and the programs were tested on a UNIVAC 1106 computer.
Author (ESA)

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N79-11304 Western Australia Univ., Nedlands.
TOROIDAL ELECTROMAGNETICS: LAPLACE EQUATION SOLUTIONS, PSEUDOANALYTIC FUNCTION SOLUTIONS, APPLICATIONS TO TOKAMAK GEOMETRIES, TOROIDAL WAVE COORDINATES, FLUID MODELS, AND METRIC MAPPINGS Ph.D. Thesis
William Martin Honig 1978 274 p
Avail: Univ. Microfilms Order No. 7817466

Considerations are derived from the complex potentials of two cylindrical vortices. For a linear infinite array of cylindrical vortices each vortex complex potential is compressed into an infinite strip. These periodic strips can be given a velocity and each can then be mapped into radially propagating annular strips which appear to correspond to the Hertzian dipole field pictures. Functions of such periodic moving coordinates can be shown to satisfy wave equations. Such moving coordinates can therefore correspond to fluid models for electromagnetic waves. Suggested fluidic models for space, for the electron, and for electromagnetic waves may have useful applications for solving wave and Laplace equations. This also depends on the ability to map arbitrary coordinates to Cartesian coordinates. Such mapping techniques which are equivalent to metric mappings are also developed.
Dissert. Abstr.

N79-11305 Texas Univ. at Austin.
CONTROL OF HOMOPOLAR GENERATOR OUTPUT PULSE CURRENT WAVESHAPE Ph.D. Thesis
Surachai Saibua 1978 174 p
Avail: Univ. Microfilms Order No. 7817703

The problem selected was to discharge an inertial energy storage into a load coil and hold a predetermined level of load current as long as possible. To obtain the possible longest flat-top pulse for each current level, the control system sought to minimize the energy dissipated in the armature circuit in reaching the desired current level, and this requirement was the same as driving the output current to that level as quickly as possible. In the theoretical studies, it was shown that the initial field flux had a large effect on how fast a desired level could be reached and this was verified experimentally. With the proper initial field flux set at the start of the run, the output current could attain the desired level for a maximum interval of time. Lower current level could be held longer because it discharged the inertial energy storage more slowly. Finally, an experimental verification was made by achieving output current control on the 5 MJ homopolar machine.
Dissert. Dissert.

N79-11306 Cornell Univ., Ithaca, N. Y.
A REAL FREQUENCY TECHNIQUE FOR BROADBAND MATCHING AN ARBITRARY LOAD TO A RESISTIVE GENERATOR Ph.D. Thesis
James Joseph Komiak 1978 190 p
Avail: Univ. Microfilms Order No. 7817863

The design of a lossless two-port equalizer operating between an arbitrary load and a resistive generator is presented. The technique is numerical method utilizing measured real frequency load data. The real frequency technique is implemented as a two step process. An ideal line segment solution for the Thevenin impedance of an equalizer as seen from the load that optimizes the objective function is first determined. The numerical aspects of this step are well-behaved because the unknown equalizer impedance is described in a particularly simple manner in terms of a number of unknown real parameters. The second part of the technique entails the approximation of the ideal line segment solution by a rational physically realizable network function. The functional form of this approximation determines network topology. Classical analytic examples are presented to demonstrate the flexibility and numerical aspects of the technique. Dissert. Abstr.

N79-11307 Cornell Univ., Ithaca, N. Y.
ANALYTICAL AND COMPUTER-AIDED TECHNIQUES FOR IMPATT REFLECTION AMPLIFIERS Ph.D. Thesis
Jing-Shown Wu 1978 162 p
Avail: Univ. Microfilms Order No. 7817883

Fundamental gain-bandwidth limitations of IMPATT diodes based on both lumped and distributed equivalent circuits are derived and analytical and computer-aided techniques for the design of broadband IMPATT diode reflection amplifiers are presented. Experimental high power reflection amplifiers designed and fabricated in microstrip to illustrate the general design techniques are described.
Dissert. Abstr.

N79-11308 Cornell Univ., Ithaca, N. Y.
HIGH PURITY LIQUID-PHASE EPITAXIAL INDIUM PHOSPHIDE FOR MICROWAVE DEVICES Ph.D. Thesis
Kwan-To Ip 1978 150 p
Avail: Univ. Microfilms Order No. 7817761

High purity indium phosphide layers were grown using the liquid phase epitaxial technique. These high purity InP layers were achieved by a combination of two factors: using high purity source InP and using indium with a low silicon content. Device applications considered include: Schottky-barriers on InP for field effect transistors; limited space charge accumulation devices for high power, high efficiency oscillators; and p(+)n IMPATT devices for material properties study, e.g., breakdown field and high field carrier velocity.
Dissert. Abstr.

N79-11309 George Washington Univ., Washington, D. C.
ON THE REALIZATION OF VOLTAGE TRANSFER FUNCTIONS BY DISTRIBUTED ACTIVE NETWORKS Ph.D. Thesis
Charles Addison Fowler, III 1978 335 p
Avail: Univ. Microfilms Order No. 7816551

It is shown that a matrix that characterizes the network can be put in a form in which its elements are dependent only on the order of the transfer function to be realized. An algorithm is presented which can generate the elements of the characteristic matrix. It is also shown that the adjoint of the characteristic matrix and the determinate of the characteristic matrix can be evaluated by means of two simple algorithms. Computer programs based on these algorithms were written. The characteristic matrices and their adjoints for transfer functions of order up to nine were obtained and tabulated. Criteria are developed which can be used to indicate whether a given transfer function of first or second order can be realized. A new method of determining realizability called the Uspensky-Descartes scheme is developed for third order functions. A design method for optimization techniques is also presented.
Dissert. Abstr.

N79-11310 Princeton Univ., N. J.
A COMBINED CORONA AND PHOTOEMISSION TECHNIQUE FOR STUDYING THE ELECTRONIC PROPERTIES OF THIN INSULATING FILMS, WITH APPLICATION TO SILICON DIOXIDE AND SILICON NITRIDE Ph.D. Thesis
Hu Herbert Chao 1978 101 p
Avail: Univ. Microfilms Order No. 7818319

The results of a study of a new technique for investigating the injection, transport, and trapping of charge carriers in thin insulating films on semiconducting substrates is presented. The technique uses internal photoinjection to provide the charge carriers and utilizes ions extracted from a corona discharge to charge the exposed surface of the insulator and thus create the electric field required for transport. Optical injection also allows

the use of an additional important technique: Optical interference within the insulator causes the ratio of the optical excitations at the two interfaces to be a strong oscillating function of the wavelength. Variation of the wavelength allow(one to separate the injection effects at the two interfaces and to determine the origin and sign of the injected carriers. An analysis of this phenomenon and its application to the corona photoemission technique is also presented. Dissert. Abstr.

N79-11311 Florida Univ., Gainesville.
EQUIVALENT-CIRCUIT MODELING OF THE LARGE-SIGNAL TRANSIENT RESPONSE OF FOUR-TERMINAL MOS FIELD EFFECT TRANSISTORS Ph.D. Thesis
Jose Ignacio Arreola 1978 141 p
Avail: Univ. Microfilms Order No. 7817424

An approach is proposed that yields equivalent-circuit models for the large-signal transient response for all electronic devices described by charge-control. The approach is applied to derive an improved equivalent-circuit model for the four-terminal MOSFET. It is suggested that the model proposed gives a better description of the physics internal to the device than was previously available. A static characterization of current and charges in the MOSFET is also proposed that unifies the descriptions of the weak, moderate, and strong inversion modes of operation. The static characterization of current and charges is used to derive functional dependencies for the equivalent-circuit components in terms of applied voltages and physical make-up of the MOSFET. Dissert. Abstr.

N79-11312 Toledo Univ., Ohio.
TRANSIENT RESPONSE TO THREE-PHASE FAULTS ON A WIND TURBINE GENERATOR Ph.D. Thesis
Leonard Joseph Gilbert 1978 143 p
Avail: Univ. Microfilms Order No. 7818530

In order to obtain a measure of its response to short circuits a large horizontal axis wind turbine generator is modeled and its performance is simulated on a digital computer. The baseline model for the simulation is the DOE/NASA 100 kW wind turbine generator. Simulation of short circuit faults on the synchronous alternator of a wind turbine generator indicates that maximum clearing times for the system tied to an infinite bus are longer than the typical clearing times for equivalent capacity conventional machines. Also, maximum clearing times are independent of tower shadow and wind shear. Variation of circuit conditions produce the modifications in the transient response predicted by analysis. The model and simulation are applicable for more extensive investigations of power systems involving wind turbine generators. Dissert. Abstr.

N79-11313* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
APPARATUS AND METHOD FOR STABILIZED PHASE DETECTION FOR BINARY SIGNAL TRACKING LOOPS Patent
Phillip M. Hopkins, inventor (to NASA) (Lockheed Electronics Corp., Houston, Tex.) Issued 10 Oct. 1978 9 p Filed 8 Dec. 1977 Supersedes N78-15331 (16 - 06, p 0742) Sponsored by NASA
(NASA-Case-MSC-16461-1; US-Patent-4,119,926;
US-Patent-Appl-SN-858765; US-Patent-Class-331-1A;
US-Patent-Class-307-232; US-Patent-Class-328-133;
US-Patent-Class-331-14; US-Patent-Class-331-23;
US-Patent-Class-331-27) Avail: US Patent Office CSCL 09A

Apparatus and method is presented for phase detection in binary signal tracking loops wherein two bandpass detectors are alternately interchanged between electrical connection with two local code reference trackin- signals in order to cancel any adverse effect of gain imbalance in the bandpass detectors and direct current offset or drift. The detectors are time shared in muliplex fashion between the two local reference signals.
Official Gazette of the U.S. Patent Office

N79-11314* National Aeronautics and Space Administration. Pasadena Office, Calif.
SPACE-CHARGE-LIMITED SOLID-STATE TRIODE Patent
Alex Shumka, inventor (to NASA) (JPL) Issued 14 Jan. 1975 7 p Filed 13 Oct. 1972 Sponsored by NASA
(NASA-Case-NPO-13064-1; US-Patent-3,860,946;
US-Patent-Appl-SN-297436; US-Patent-Class-357-22) Avail: US Patent Office CSCL 09A

A solid-state triode is provided from a wafer of nearinstrinsic semiconductor material sliced into filaments of rectangular cross section. Before slicing, emitter and collector regions are formed on the narrow sides of the filaments, and after slicing gate regions are formed in arrow strips extending longitudinally along the midsections of the wide sides of the filaments. Contacts are then formed on the emitter, collector and gate regions of each filament individually for a single filament device, or in parallel for an array of filament devices to increase load current.
Official Gazette of the U.S. Patent Office.

N79-11315* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
REMOTE LIGHTNING MONITOR SYSTEM Patent
Carl L. Lennon and Thomas O. Britt, inventors (to NASA) Issued 8 Aug. 1978 8 p Filed 29 Mar. 1977 Supersedes N77-21319 (15 - 12, p 1577)
(NASA-Case-KSC-11031-1; US-Patent-4,105,966;
US-Patent-Appl-SN-782482; US-Patent-Class-324-113;
US-Patent-Class-324-102; US-Patent-Class-324-133) Avail: US Patent Office CSCL 09C

An apparatus for monitoring, analyzing and accurately determining the value of peak current, the peak rate of change in current with respect to time and the rise time of the electrical currents generated in an electrical conductive mast that is located in the vicinity where lightning is to be monitored is described. The apparatus includes an electrical coil for sensing the change in current flowing through the mast and generating a voltage responsive. An on-site recorder and a recorder control system records the voltages produced responsive to lightning strikes and converts the voltage to digital signals for being transmitted back to the remote command station responsive to command signals. The recorder and the recorder control system are carried within an RFI proof environmental housing into which the command signals are fed by means of a fiber optic cable so as to minimize electrical interference.
Official Gazette of the U.S. Patent Office

N79-11316*# Rockwell International Corp., Anaheim, Calif. Electronic Devices Div.
DEVELOPMENT OF LOW COST, HIGH RELIABILITY SEALING TECHNIQUES FOR HYBRID MICROCIRCUIT PACKAGES. PHASE 2, SUPPLEMENT 1: MOISTURE PERMEATION OF ADHESIVE-SEALED HYBRID MICROCIRCUIT PACKAGES Final Report
K. L. Perkins and J. J. Licari Aug. 1978 81 p refs
(Contract NAS8-31992)
(NASA-CR-150844; C-77-1262/501) Avail: NTIS HC A05/MF A01 CSCL 09C

The susceptibility of adhesive-sealed ceramic packages to moisture permeation was investigated. The two adhesives, Ablebond 789-1 and Epo-Tek H77, were evaluated as package sealants. These adhesives were previously selected as the most promising candidates for this application from a group of ten adhesives. Ceramic packages sealed with these adhesives were exposed to temperature-humidity conditions of 25 C/98 percent RH, 50 C/60 percent RH, 50 C/98 percent RH, and 85 C/85 percent RH and their moisture contents using were monitored solid state moisture sensors sealed inside them. Five packages were tested at each of these exposures - two ceramic packages sealed with each of the two adhesives and one seam-sealed gold-plated Kovar package. This latter package was included to serve as a control. The results showed that the adhesive-sealed packages were not hermetic to moisture. The rates at which moisture entered the packages increased with the severity of the exposure environments (i.e., higher temperatures and higher moisture vapor pressures) with greater dependence on temperature than on moisture vapor pressure. F.O.S.

N79-11317# Illinois Univ. at Urbana-Champaign, Savoy. Coordinated Science Lab.
A NEW METHOD FOR THE ANALYSIS OF DIELECTRIC WAVEGUIDES FOR MILLIMETER WAVE AND OPTICAL INTEGRATED CIRCUITS M.S. Thesis
Ping Yang Apr. 1978 78 p refs
(Contract DAAB07-72-C-0259)

(AD-A057651; R-813; UILU-ENG-78-2206) Avail: NTIS HC A05/MF A01 CSCL 09/5

A new method for the analysis of dielectric waveguides for millimeter and optical integrated circuits and a new dielectric waveguide structure are presented. A comparison between this new method and the previously available approaches by Itoh is given. Experimental results are described and the agreement between theory and experiment is shown to be quite good.

Author (GRA)

N79-11318# Purdue Research Foundation, Lafayette, Ind. School of Materials Engineering.

THE EFFECTS OF SUBSTRATE COMPOSITION ON THICK FILM CIRCUIT RELIABILITY Quarterly Report, 1 Feb. - 30 Apr. 1978

R. W. Vest 30 May 1978 25 p refs

(Contract N00019-78-C-0236)

(AD-A056076; QR-1) Avail: NTIS HC A02/MF A01 CSCL 09/1

Thick film resistors were prepared with and without AlSiMag 614 substrate dissolved in the resistor glass. The electrical characteristics of these devices were studied during sinter/anneal cycles up to 525 C. Two effects were identified, one which results in a slow decrease in resistance with time at the lower anneal temperatures and another which results in a more rapid increase in resistance at the higher anneal temperatures. The mechanisms of these effects are discussed in terms of changes in glass composition resulting from resistor - substrate interactions.

Author (GRA)

N79-11319# E-Systems, Inc., Huntington, Ind. Memcor Div.

AN/VRC-12, 43-49 SERIES RADIO SET SILICONIZATION PRODUCT IMPROVEMENT PROGRAM Final Technical Report, 30 Jun. 1977 - 30 Apr. 1978

Kevin P. Yelton May 1978 386 p refs

(Contract DAAB07-76-C-0135)

(AD-A056084; CORADCOM-76-C-0135) Avail: NTIS HC A17/MF A01 CSCL 17/2

Obsolete germanium devices in the AN/VRC-12 series radios were replaced with silicon devices. A significant reduction in types of transistors used was realized. Three vital modules were completely redesigned to eliminate areas of functional deficiency. Those modules are the A2000A Crystal Switch Assembly, the A5200A/A5300A Squelch System and the A9000A/A9400B Power Supply Assembly. Improved performance and higher reliability resulted from the Product Improvement Program. The siliconized modules are completely compatible with the germanium modules except that the A5200A/A5300A and the A9000A/A9400B must be interchanged as single units.

Author (GRA)

N79-11320# Arinc Research Corp., Annapolis, Md.

DEFINITIZE AND PREPARE OFF-THE-SHELF (OTS) ELECTRONIC TEST EQUIPMENT (ETE) SPECIFICATIONS Final Report

Larry J. Graham, Albert L. Simmons, and Benjamin F. Paiz Jul. 1978 304 p refs

(Contract DAEA18-72-A-0005)

(AD-A056526; Rept-1076-01-3-1770) Copyright. Avail: Issuing Activity CSCL 14/2

ARINC Research Corporation has definitized previously developed Off-the-Shelf (OTS) Electronic Test Equipment (ETE) Specifications by converting them into full Military Specifications. The specifications are to be used by the U.S. Army Communications and Electronics Materiel Readiness Command (CERCOM) in competitive evaluation and procurement of OTS ETE to replace appropriate U.S. Army items of general purpose Test, Measurements, and Diagnostic Equipment (TMDE). GRA

N79-11321# JMR Systems Corp., Salem, N. H.

ELECTRET NOISECANCELLING MICROPHONE Final Report, 28 Jul. 1976 - 28 Dec. 1977

Donald W. Mackiernan and Alan P. Woodward Apr. 1978 71 p

(Contract DAAB07-76-C-0175)

(AD-A056286; ECOM-76-0175-F) Avail: NTIS HC A04/MF A01 CSCL 09/5

This document covers the technical details of advanced development work performed to adapt the electret principle for the purpose of improving noise-cancelling microphones for military use. A major objective was to achieve a flat frequency response over a greater bandwidth and noise cancellation characteristics extending to a higher frequency cut-off point than previously possible with dynamic units. Author (GRA)

N79-11322# Westinghouse Research and Development Center, Pittsburgh, Pa.

ADVANCED CURRENT COLLECTION RESEARCH Annual Technical Report for period ending 18 Feb. 1978

D. L. Greene, J. L. Johnson, P. K. Lee, I. R. McNab, C. J. Mole, J. J. Schreurs, and O. S. Taylor 19 Apr. 1978 163 p refs

(Contract N00014-76-C-0683; ARPA Order 3153)

(AD-A056273; Rept-78-9B21-AMCOL-R1) Avail: NTIS HC A08/MF A01 CSCL 09/3

The program is directed towards obtaining a greatly improved understanding of the physical factors which govern high current brush performance, leading to the development and demonstration of advanced brush materials. These materials are to be demonstrated at 7.75 MA/sq in. (5 kA/sq in.) in a machine application as the ultimate goal of the program. Progress is reported in the attainment of this goal in the areas of materials characterization, brush/ring dynamics, brush heat transfer, atmosphere control, contact interface investigations, multi-element brush research, and monolithic brush material research. The participation of university researchers in the investigation of specific technology areas is also described. GRA

N79-11323# Auburn Univ., Ala. Dept. of Physics

SECOND BREAKDOWN SUSCEPTIBILITY OF SILICON-ON-SAPPHIRE DIODES Final Report, 15 Jul. 1977 - 31 Mar. 1978

Paul P. Budenstein, Aradhana Baruah, and Edward Knight 8 Jun. 1978 68 p refs

(Grant DAAG29-77-G-0189)

(AD-A056276; ARO-15273.1-A-EL) Avail: NTIS HC A04/MF A01 CSCL 20/12

The present report is the first portion of a second breakdown study of a specially designed array of silicon-on-sapphire diodes. The goal is to relate second breakdown susceptibility to device characteristics. The diodes, fabricated by Rockwell International, allow the roles of device doping, diode width, n-region length, junction spikes, metallization spikes, and current crowding geometries to be explored by a stroboscopic method. Exciting pulses of 0.1, 1 and 10 microseconds duration are employed. At this date, the experiments have been set up, but the bulk of the experimentation remains to be done. A simplified model for describing the features of current filamentation that lead to second breakdown has been pursued in some depth, but this is also to be regarded as in an interim stage. Author (GRA)

N79-11324# Pennsylvania State Univ., University Park. Materials Research Lab.

CERAMIC PIEZOELECTRIC TRANSDUCERS Annual Summary Report, 1 Jan. - 31 Dec. 1977

L. E. Cross, J. V. Biggers, and R. E. Newnham Jan. 1978 157 p refs

(Contract N00014-76-C-0515; ARPA Order 3203)

(AD-A056287) Avail: NTIS HC A08/MF A01 CSCL 09/5

A major part of the effort has been concerned with the development of new techniques for the fabrication of diphasic ceramic and ceramic plastic composites and with investigation of the manner in which local and macroscopic symmetry and phase interconnection (connectivity) controls the coupled elasto-electric (piezoelectric) and thermo-elasto-electric (pyroelectric) properties of the composite. Replicating a natural microstructure of desired connectivity, a new type of flexible ceramic elastometer composite has been developed which exhibits g sub 33 constants over an order of magnitude larger than PZT and has interesting potential for many passive voltage generation applications such as in hydrophones and towed arrays. GRA

N79-11325# Illinois Univ. at Urbana-Champaign, Urbana. Coordinated Science Lab.

ON THE DESIGN OF SELF-CHECKING SYSTEMS UNDER VARIOUS FAULT MODELS Ph.D. Thesis

Jean Dussault Oct. 1977 106 p refs

(Contract DAAB07-72-C-0259)
(AD-A056280; R-791; UILU-ENG-77-2238) Avail: NTIS HC A06/MF A01 CSCL 09/2

One of the objectives of this work is to study the design of totally self-checking systems that are made up of blocks whose fault behavior is different from one another. Consequently, different codes are mentioned and their associated circuit structures discussed in detail. Codes that are used to protect against unidirectional errors are studied. Systematic and non-systematic codes are shown to have the same basic structure. The structure of non-systematic unordered codes, more precisely the class of fixed-weight codes, if further examined. It is shown that these codes have codewords that can be effectively classified in terms of congruence, cycling and complementation classes. The capabilities of unordered codes are defined with respect to circuit structure and fault models. Some results, based on the previous classification scheme, are presented on the design of two-level minimal checkers. GRA

N79-11326# Princeton Univ., N. J. Dept. of Aerospace and Mechanical Sciences.
RADIATION EFFECTS ON MOS/SOS SEMICONDUCTOR DEVICES Final Report, 1 Feb. 1976 - Jan. 1978
B. S. H. Royce 31 Jan. 1978 44 p refs
(Contract DAAG39-76-C-0070; Grant DAAG39-76-R-9118)
(AD-A056005) Avail: NTIS HC A03/MF A01 CSCL 20/12

Measurements have been made on radiation induced leakage currents in MOS/SOS structures and the effects of optical bleaching and further irradiation under zero bias conditions have been studied. In order to understand the role played by bulk traps in Al2O3 in the radiation induced leakage currents and to identify the possible lattice defects associated with these traps. Thermally Stimulated Current Techniques have been employed. Optical bleaching and trap repopulation studies have been made in conjunction with the thermally stimulated current measurements. A review of data on trapping states in Al2O3 is presented and models for the trapping and charge compensation processes involved in the back channel leakage are discussed. Author (GRA)

N79-11327# Edgerton, Germeshausen and Grier, Inc., Salem, Mass. Electronic Components Div.
REPETITIVE SERIES INTERRUPTER II Interim Report, 1 Oct. 1977 - 31 Jan. 1978
Robert F. Caristi, Robert P. Simon, and David V. Turnquist Jun. 1978 67 p
(Contract DAAB07-76-C-1301)
(AD-A055999; ECOM-76-1301-7; IR-7) Avail: NTIS HC A04/MF A01 CSCL 09/1

The interruption characteristics have been established for six developmental 'plasma chute' interrupters, five rated at 15 kV and one rated at 30 kV. Six-hundred ampere interruptions at 20 kV have been achieved with a magnetic field energy of less than 8 joules. The most efficient interaction channel geometry has been found to be one which contains both a 'chuted' surface against which the discharge is magnetically driven, and an unchuted (smooth) surface located behind the driven discharge, the presence of which latter surface minimizes the availability of plasma to sustain the discharge. Typical interaction column drops have been found to be 300 to 400 volts per section (20 to 26 volts/cm) at reasonable tube pressures with no more than three (and possibly two) sections being adequate for the operation of tubes rated at 50 kV. Holdoff-section voltage drops of about 120 volts have been observed for holdoff sections capable of withstanding 30 kV. A total tube drop of 830 volts has been observed at the 25 kV, 18.5 A level. Linear extrapolation of existing data to the 50 kV, 1000 A level shows that reliable interruption should be achievable with a magnetic field energy of the order of 10 joules for an interrupter having a total tube drop of about 1200 volts, or 2.4% of the system's operating voltage. Author (GRA)

N79-11328# Army Construction Engineering Research Lab., Champaign, Ill.
DEVELOPMENT OF CONDUIT DESIGN ANALYTICAL PROCEDURE Interim Report
William Croisant, Paul Nielsen, David Sieber, and Raymond G. McCormack Jun. 1978 149 p refs
(AD-A056218; CERL-IR-M-234) Avail: NTIS HC A07/MF A01 CSCL 09/5

This report presents proposed models for analysis of the electromagnetic pulse (EMP) signals in conduit shielded circuits. The models are intended for use in an analytical procedure for evaluating conduit system designs currently being developed. The development of preliminary models for calculating (1) EMP penetration in solid conduit, (2) EMP leakage through defects, and (3) the effect of circuit impedances on EMP induced signals is presented. EMP properties and conduit physical properties important to the conduits shielding characteristics are examined. Both time domain and frequency domain analyses are presented. Author (GRA)

N79-11329# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Chemical Systems Lab.
ELECTRICAL CONDUCTIVITY OF MOIST AIR. 1. CELL DESIGN AND FABRICATION FROM THE WATER ION CLUSTER THEORY Technical Report, Aug. - Nov. 1977
Hugh R. Carlon May 1978 28 p refs
(AD-A056235; AD-E410034; ARCSL-TR-78007) Avail: NTIS HC A03/MF A01 CSCL 07/4

Beginning with the infrared water ion cluster theory, this report outlines the development of equations leading to the design of an air conductivity cell which has been fabricated. In earlier work, it was shown that anomalous continuum absorption by the atmosphere of infrared radiation could be attributed to intermolecular, hydrogen bonds in polymolecular ion clusters of water which are always present in equilibrium concentrations in samples of water vapor. For example, these clusters can have the form H3O(-).(H2O) sub n, where n = 10 or 11 in moist air, paired with more mobile ions such as OH(-). Therefore, electrical conductivity measurements of moist air should show direct correlations with water cluster concentrations and hence with infrared transmission of the atmosphere. Agreement of preliminary experimental data from the cell with theory is good, suggesting new avenues of investigation in electrostatics such as space charge dissipation. Author (GRA)

N79-11330# Avco Systems Div., Wilmington, Mass.
TWO POSITION FAIL SAFE SWITCH Final Technical Report, May 1976 - Jan. 1978
Murray E. Wolf Oct. 1978 77 p
(Contract DAAA21-76-c-6218)
(AD-A057661; AUSD-0098-78-RR) Avail: NTIS HC A05/MF A01 CSCL 09/1

The Two Position Fail Safe Switch is a strong link normally open (unarmed position), rotary switch specifically designed to safely withstand abnormal environments of high temperature, static crushing load, and impact shock. This switch configuration contains 14 normally open functional circuits and one normally closed monitor circuit. It basically consists of a strong outer structure made of high strength steel and an inner core made of high compressive strength/high temperature ceramic. GRA

N79-11331# Drexel Univ., Philadelphia, Pa. Dept. of Mechanical Engineering and Mechanics.
AN ADAPTIVE ACCEPT-REJECT MODULE FOR TRANSDUCER EVALUATION AND POTENTIAL FLAW CLASSIFICATION APPLICATIONS Final Report, Oct. 1976 - Sep. 1977
Joseph L. Rose and Gurvinder P. Singh Lakehurst, N. J. Naval Air Eng. Center 21 Jul. 1978 76 p refs
(Contract N68335-77-C-0556; WF41461400)
(AD-A057332; NAEC-GSED-121) Avail: NTIS HC A05/MF A01 CSCL 09/1

Advanced concepts and various approaches on the transducer compensation module along with the concepts on an intelligent flaw detector module are presented. An intelligent flaw detection system is a computer controlled ultrasonic inspection system capable of: indicating the correct inspection procedure for parts being inspected; analyzing the transducer and system operation to insure that meaningful data is acquired; and interpreting the data and compensating for any system variations that may occur due to changes or aging of the transducer and/or couplant variations or any other inconsistencies in the system. GRA

N79-11332# California Univ., Livermore. Lawrence Livermore Lab.
DESIGN AND IMPLEMENTATION TECHNIQUES FOR TWO-DIMENSIONAL DIGITAL FILTERS Ph.D. Thesis
R. E. Twogood Nov. 1977 23 p refs
(Contract W-7405-eng-48)
(UCRL-52370) Avail: NTIS HC A02/MF A01

The techniques are characterized by their applicability to a large number of practical problems of current interest in 2-D signal processing. The sectioning approach to filter implementation is analyzed with emphasis on minimizing the total computation required. An optimal sectioning procedure is formulated, and examples are given. The problem of designing stable 2-D recursive digital filters is addressed. A very efficient design procedure for separable 2-D recursive filters is presented. Two techniques are also presented for designing recursive filters of the more general half-plane variety. Example designs are provided for each technique discussed. DOE

N79-11333# Westinghouse Electric Corp., Pittsburgh, Pa. Large Rotating Apparatus Div.
SUPERCONDUCTING GENERATOR DESIGN Final Report, 1 Sep. 1975 - 31 Aug. 1977
James H. Parker, Jr. and Raymond A. Towne Nov. 1977 677 p Sponsored by Elec. Power Res. Inst.
(EPRI Proj. 429-1)
(EPRI-EL-577) Avail: NTIS HC A99/MF A01

The principal results of a detailed conceptual design study of 300 and 1200 MVA turbine generators utilizing superconducting windings are presented. Designs are reported that cover a range of reactances. Design concepts utilized for the rotor involve an NbTi superconductor, a double-shield system, a flexible-disc thermal contraction concept, a convection-dominated helium circuit and an automatic helium level control. The armature designs are based on a new spiral winding concept which is applied at low voltage (14 kV) and at high voltage (up to 500 kV). A development plan was developed that lays out the tasks and schedule leading to the construction and utility test of a 300 MVA superconducting unit. DOE

N79-11334# Bendix Corp., Kansas City, Mo.
COMPUTER APPLICATIONS AND HYBRID MICROCIRCUITS
Larry Sheets 29 Mar. 1978 7 p Presented at the EVER-37 CAD-CAM meeting, Albuquerque, N. Mex., 10 Apr. 1978
(Contract EY-76-C-04-0613)
(BDX-613-2020; Conf-780456-1) Avail: NTIS HC A02/MF A01

The Kansas City Division of the Bendix Corp. computer graphics are used to prepare formal drawings in a specified drawing system. Introduction of a system worked out with Sandia Laboratories resulted in reduced time for through-put, faster processing of changes, and steady (rather than increased employment figures.) The system is used on printed wiring boards, hybrid microcircuits, and test equipment schematics. DOE

N79-11335# Ames Lab., Iowa.
THEORY OF FLUX-FLOW NOISE IN SUPERCONDUCTORS
J. R. Clem 1978 9 p Presented at 5th Conf. on Noise in Phys. Systems, Bad Nauheim, West Germany, 13 Mar. 1978
(Contract W-7405-eng-82)
(IS-M-138; Conf-780349-1) Avail: NTIS HC A02/MF A01

Voltage noise in magnetic flux-containing type-II superconductors whose linear dimensions are large by comparison with the field-dependent penetration depth lambda/sub B/ is attributable to the motion of singly-quantized flux vortices. The instantaneous voltage is expressible, as a linear superposition of instantaneous contributions from all moving vortices in the specimen. All the information about the vortex dynamics is contained in the vortex-current correlation function K/sub alpha beta/(rho vector, rho prime vector, T) or its Fourier transform. The experimentally measurable quantities (autocorrelation and cross-correlation functions and the corresponding power spectra) are related to K/sub alpha beta/, by means of known resolution functions g vector(rho vector), which depend upon the measuring circuit geometry. There is still only a qualitative understanding of the spatial and temporal behavior of K/sub alpha beta/. A good quantitative theory is needed to describe the basic dynamical processes associated with vortex motion past pinning sites. DOE

N79-11336# Argonne National Lab., Ill.
MODEL AIR-SUPPORTED DRUM-TYPE HOMOPOLAR GENERATOR
R. L. Kustom, R. E. Fuja, R. B. Wehrle, R. P. Smith, and T. J. Kovarik 1977 13 p refs Presented at Seminar on Energy Storage, Compression and Switching, Canberra, Australia, 15 Nov. 1977
(Contract W-31-109-eng-38)
(CONF-771132-6) Avail: NTIS HC A02/MF A01

A single cylinder, drum-type homopolar generator was designed and built for the purpose of developing a simple air support system for thin cylinder rotors operated at high surface velocities and significant radial drum growth. The model has an aluminum cylinder which is 0.32 cm thick, 25 cm in diameter, and 12.7 cm long. It is designed to operate at a peak current of 2500 A and to store a total of 40kj with a surface velocity of 305m/sec. DOE

N79-11337# Supercon, Inc., Natick, Mass.
MULTIFILAMENTARY Nb3Sn COMPOSITE CONDUCTORS: FINAL REPORT TO LAWRENCE LIVERMORE LABORATORY Final Report
1 Mar. 1978 13 p ref
(Contract W-7405-eng-48)
(UCRL-13851) Avail: NTIS HC A02/MF A01

The development of manufacturing techniques for a multifilamentary Nb3Sn composite conductor of unique design is described. The uniqueness of the design lies in the use of hollow niobium filaments in a high conductivity copper matrix. Each filament contains a core of bronze. During heat treatment the tin migrates from the bronze to the inner wall of the niobium filament where the Nb3Sn is formed. The outer unreacted part of the niobium filament serves as a barrier to protect the purity and high conductivity of the copper. Thus, each filament is stabilized in the same way as in the composite NbTi conductors. Test samples of conductor containing large numbers of filaments were made from small two inch diameter billets. DOE

N79-11338# McGraw-Edison Power Systems Div., Canonsburg, Pa.
SURGE BEHAVIOR OF UD CABLE SYSTEMS Final Report
Robert E. Owen Apr. 1978 108 p refs
(EPRI Proj. 795-1)
(EPRI-EL-720) Avail: NTIS HC A06/MF A01

The behavior of surges that enter an underground distribution system was investigated. The industry accepted, for the most part, that the margin of protection provided by a typical distribution arrester installed at the overhead underground junction of a 15-kV underground system will be adequate to protect the distribution equipment with a high level of confidence. However, this margin of protection is eroded as the distribution voltage is increased to 25 and 35 kV. The surge attenuation for a spectrum of underground distribution cables is described. The surge characteristics for a number of protective schemes were demonstrated. Key variables that constrain the protection engineer when he studies the merits of various protective schemes are identified. Laboratory evaluations and digital computer simulations were used as investigative tools. DOE

N79-11339# Brookhaven National Lab., Upton, N. Y.
INFLUENCE OF STRESSES ON SUPERCONDUCTING PROPERTIES OF Nb3Sn CONDUCTORS
M. Suenaga, T. S. Luhman, W. B. Sampson, T. Onishi, and C. J. Klamut 1978 27 p refs Presented at the Workshop on the Develop. of Superconductors for Fusion Power, Germantown, Md., 26 Jan. 1978
(Contract EY-76-C-02-0016)
(BNL-24102; Conf-780124-3) Avail: NTIS HC A03/MF A01

The most important finding in this study is that a Nb3Sn composite wire can sustain an effective mechanical strain well beyond 1% if a proper ratio of the matrix to the Nb core has been chosen. DOE

N79-11340# Sandia Labs., Albuquerque, N. Mex.
EXPLOSIVELY ACTUATED FAST-OPENING SWITCHES FOR

VERY LARGE CURRENTS
R. I. Butler and B. W. Duggin Oct. 1977 29 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1438) Avail: NTIS HC A03/MF A01

The use of high explosives to interrupt electric current by fast-opening switch mechanisms was investigated in a series of eight experiments. The conducting link in seven of the experiments was a glass-lined plasma-filled cavity that was closed explosively. In the eighth experiment a foam-metal link was driven into the liquid-vapor phase and expanded into a ceramic cavity. Resistance increases and resultant voltage spikes that corresponded in time with the particle velocities of the collapsing walls were obtained. However, unknown high-resistance paths prevented voltage gradients greater than 10 to the 5th power to 10 to the 6th power V/m. DOE

N79-11341# Mullard Ltd., London (England).
MULLARD COMPONENTS FOR GOVERNMENT ELECTRONIC SYSTEMS. VOLUME 1: MANUFACTURE REPORT
Paris ESA Apr. 1978 252 p refs Original contains color illustrations 2 Vol.
(Contract ESA-2125/73-AK)
(ESA-CR(P)-1088-Vol-1) Avail: NTIS HC A12/MF A01

The manufacturing, assembly, and verification testing of 6 pyroelectric fan beam testers type PE300X was studied. An encapsulation was designed which could accommodate sensitive areas up to 8mm x 4mm. the element size chosen for the fan beam detector was 8mm x 1.5mm, and that for the pencil beam 1.2 sq mm. Owing to system requirements a smaller encapsulation was developed and designed for the pencil beam detector. The development of the thick film preamplifier is discussed. A major problem encountered was that of thermally induced noise phenomena. Temperature induced noise was reported to be caused by breakup of the thin front electrode. Increasing the thickness of the electrode and screening during manufacture was felt to have obviated this effect. It is concluded that the presence of moisture within the element compartment is the most likely cause of this type of failure. Author (ESA)

N79-11342# Mullard Ltd., London (England).
MULLARD COMPONENTS FOR GOVERNMENT ELECTRONIC SYSTEMS. VOLUME 2: QUALIFICATION REPORT
Paris ESA Apr. 1978 88 p 2 Vol.
(Contract ESA-2125/73-AK)
(ESA-CR(P)-1088-Vol-2) Avail: NTIS HC A05/MF A01

Six fan beam detectors type PE300X were subjected to verification tests described in the Qualification Test Procedures Specification TS/001/75/P300 Revision 2. One detector was found to be defective and is the subject of a defect report, included as Appendix 1. A replacement detector was subsequently built. Author (ESA)

N79-11343# Societe Crouzet, Valence (France). Div. Aerospatial et Systemes.
SECA (ELECTRONIC ADAPTIVE CONTROL SYSTEM) PHASE 3 STUDY Final Report
J. P. Aulagnon Paris ESA 20 Feb. 1978 167 p In FRENCH
(Contract ESTEC-2949/76-NL-AK(SC))
(ESA-CR(P)-1098) Avail: NTIS HC A08/MF A01

The SECA prototype was analyzed critically with emphasis on the analog-numeric conversion subsystem, minimum microprocessor occupation time, and possibility of gain commutation for low level signals. The addition of an events dating interface was studied. The realization of an input/output bus model for SECA is presented. Three dialogue modes between this interface and the microprocessor were considered: programmed dialogue, dialogue by interruptions or by direct access memory. A promising solution was found to be a master-slave biprocessor, the slave managing the input/output procedures on the bus. ESA

N79-11344# National Bureau of Standards, Washington, D. C. National Engineering Lab.
GOVERNMENT PROGRAMS ON ADVANCED TECHNOLOGY AND MANUFACTURING TECHNIQUES: COMMENTS ON USA, JAPAN, AND EUROPE
W. Murray Bullis Jun. 1978 17 p refs
(PB-283223/6; NBSIR-78-1482) Avail: NTIS HC A02/MF A01 CSCL 09A

International challenges are being viewed by many in industry as requiring responsive efforts by the Federal Government. One such response could be in the form of technological cooperation between government and industry in areas where the industry may desire assistance in solving generic design, manufacturing, or testing problems. The Department of Commerce is considering new mechanisms for carrying out such cooperative efforts. These mechanisms are described following a brief review of other past and present government programs in advanced technology and manufacturing techniques, both here and abroad. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N79-11345 Alabama Univ., University.
PROXIMAL RELATIONS AND P-n-FLOWS Ph.D. Thesis
Chinku Chu 1977 49 p
Avail: Univ. Microfilms Order No. 7818859

Proximal relations and related notions in flows are investigated, and the dense action property in flows is introduced. The latter is a special property of the topological phase group on the phase space in a given flow. The dense action property is independent of being distal or proximal. Some relations between flows with the dense action property and homomorphisms are described. A sufficient condition for a flow to have the dense action property is explored. It is shown that every mimimal set of a compact flow has the dense action property. Various properties of proximal relations in flows are described, and the products of P to the nth power flows are developed. Finally, some related examples are presented. Dissert. Abstr.

N79-11346 Columbia Univ., New York.
TRANSITION POOL-BOILING HEAT TRANSFER FROM HORIZONTAL FLAT SURFACES Ph.D. Thesis
Bambang Soehendro 1978 135 p
Avail: Univ. Microfilms Order No. 7819442

Data on transition pool boiling from horizontal plates to several organic liquids are presented. Condensing steam was utilized as the heat source, and simultaneously to regulate the surface temperature. Copper and nickel plates of different thicknesses were tested with pentane, acetone, hexane and benzene. An empirical equation to correlate heat flux, q, and temperature difference, T, was developed using critical heat flux conditions. Stability of the boiling process is shown to be determined by the ratio of thermal conductance below the boiling surface and the slope of the q vs T curve, and also by the ratio of critical and initial size of the wet patch. Effect of thermal properties of plate material and boiling liquid, as well as the steam condensation on boiling stability were formulated in the equation to determine the maximum stable heat flux in transition pool boiling from horizontal plates. Dissert. Abstr.

N79-11347 Akron Univ., Ohio.
AN ANALYTICAL STUDY OF LAMINAR AND TURBULENT MAGNETO-FLUID DYNAMIC BOUNDARY LAYER FLOW WITH HEAT TRANSFER Ph.D. Thesis
Woodrow Allen Fiveland 1978 242 p
Avail: Univ. Microfilms Order No. 7819069

An analysis of incompressible laminar and turbulent magneto-fluid dynamic boundary layer flow with heat transfer was made. Two magnetic field configurations were investigated: the magnetic field fixed to the plate and the magnetic field fixed to the fluid. The magnetic field was imposed transverse to the flow direction over an electrically insulated plate with the specification that all flows have small magnetic Reynolds number. Solutions for the laminar and turbulent thermal boundary layers were obtained using a finite difference representation of the continuity, momentum and energy equations. For laminar flow steady and unsteady heat transfer with steady flow was investigated. For

turbulent flow, steady heat transfer with steady flow was studied. A theoretical model of turbulent viscosity was developed to characterize its behavior in a turbulent magneto-fluid dynamic flow, including the effects of turbulence suppression.
Dissert. Abstr.

N79-11348 Princeton Univ., N. J.
ON NONLOCAL FLUID MECHANICS AND TURBULENCE Ph.D. Thesis
Charles Gregory Speziale 1978 148 p
Avail: Univ. Microfilms Order No. 7818355

By utilizing a known representation theorem for nonlinear functionals, a nonlinear theory is developed subject to frame-indifference and thermodynamic considerations. Within the framework of the nonlocal theory it is shown that the condition of vanishing Reynolds stresses on solid boundaries can be satisfied identically for a wide class of flows. In order to show the usefulness of the theory, two critical problems are solved. The are: (1) starting flow in a rectangular pipe solved for a Reynolds number in the transition region to turbulence; and (2) fully developed channel flow. Dissert. Abstr.

N79-11349 Johns Hopkins Univ., Baltimore, Md.
EXPERIMENTS IN TURBULENT TRANSPORT AND MIXING Ph.D. Thesis
Stavros Tavoularis 1978 313 p
Avail: Univ. Microfilms Order No. 7817980

The evolution of experimental turbulence research and some of the instruments connected with it are reviewed briefly. Measurements of several moments, one- and two-point correlation functions, spectra, integral scales, microscales, and probability densities of the turbulent velocities, temperature fluctuations, and temperature-velocity products are reported. Integral scale ratio, velocity and temperature fields behind a turbulence generating grid with alternate rods heated are compared with prior data behind grids with every rod heated. Moderate to small Reynolds number range of isotropic turbulence show the streamwise velocity derivative skewness factor to increase with decreasing Reynolds number. This trend was found for 150 greater than or equal to R sub lambda greater than or equal to 4. Dissert. Abstr.

N79-11350 Princeton Univ., N. J.
LIMITATIONS ON HYDROGENIC GAS TRANSPORT AT ULTRA LOW PRESSURES Ph.D. Thesis
Andrew Stephen Zarchy 1978 95 p
Avail: Univ. Microfilms Order No. 7818364

The propensity of gases and molten salts to impede tritium permeation in fusion reactor plants was studied. Results indicate that helium as a coolant or LiBeF3 as a blanket material would reduce tritium permeation in extant reactor designs to negligible rates. A procedure is proposed for evaluating the tritium permeation characteristics of novel reactor designs. The role of surface phenomena at ultra low pressures was examined experimentally. Tritium permeation measurements with tritium driving pressures in the range of 1.3 x 10 to the -7th power to 2.6 x 10 to the -5th power Pa are reported. Results with 304 stainless steel at 573 to 723 K confirm the Strehlow-Savage model and indicate the existence of thin but tough residual film. The apparatus, capable of maintaining driving pressures as low as 10 to the -8th power Pa, is described along with a technique for electropolishing the interior surface of tubes and a model for permeation of mixed hydrogen isotopes. Dissert. Abstr.

N79-11351 Columbia Univ., New York.
FLOW OF ELASTIC AND VISCOELASTIC SPHERES IN TUBES Ph.D. Thesis
Husnu Tozeren 1978 109 p
Avail: Univ. Microfilms Order No. 7819455

The flow of deformable particles suspended in a viscous fluid through rigid tubes was considered for: (1) the steady motion of closely-fitting elastic incompressible spheres through cylindrical tubes and (2) unsteady flow of closely-fitting incompressible viscoelastic spheres through taper tubes. This study was originally motivated by an interest in the flow of white cells in narrow capillary blood vessels. However, the theory may be applicable also in some other systems involving particle-fluid interactions, such as the motion of red blood cells in narrow capillaries and transport of encapsulated matter in pipelines. In such cases, the present model may serve as a qualitative guide to the nature of results to be expected. Dissert. Abstr.

N79-11352*# California Inst. of Tech., Pasadena. Graduate Aeronautical Lab.
THE FLYING HOT WIRE AND RELATED INSTRUMENTATION Final Report
Donald Coles, Brian Cantnell, and Alan Wadcock Nov. 1978 62 p refs
(Grant NGL-05-002-229)
(NASA-CR-3066) Avail: NTIS HC A04/MF A01 CSCL 14B

A flying hot-wire technique is proposed for studies of separated turbulent flow in wind tunnels. The technique avoids the problem of signal rectification in regions of high turbulence level by moving the probe rapidly through the flow on the end of a rotating arm. New problems which arise include control of effects of torque variation on rotor speed, avoidance of interference from the wake of the moving arms, and synchronization of data acquisition with rotation. Solutions for these problems are described. The self-calibrating feature of the technique is illustrated by a sample X-array calibration. Author

N79-11353# Pennsylvania State Univ., University Park. Applied Research Lab.
THE SPECTRAL SHAPE OF FLOW NOISE, TURBULENCE AND WALL PRESSURE FLUCTUATIONS AND INTERRELATION Final Report
J. P. Clay 16 Mar. 1978 27 p refs
(Contract N00017-73-C-1418)
(AD-A056291; TM-78-53) Avail: NTIS HC A03/MF A01 CSCL 20/4

An elementary model of how a turbulent boundary layer (b.l.) generates noise is analyzed. Two similarity hypotheses are given which relate b.l. turbulence to flow noise. Dynamic pressures come from the forces created by the interaction of eddies on the viscous sublayer where velocity components normal to the wall are brought to rest; and the forces are proportional to the second power of the eddy velocities and the distribution of separation distance between pressure points on the wall is the same as the distribution of eddy sizes. It is concluded that flow noise, wall pressure fluctuations and b.l. turbulence all have the same spectral shape in frequency space. Data on wall pressures fluctuations generally have a f to the -11/3 power form due to spatial averaging by the pressure sensor. Corrections for pressure sensor averaging are given and experimental data is given to demonstrate the validity of the correction. GRA

N79-11354# Naval Ship Research and Development Center, Bethesda, Md.
NASTRAN IMPLEMENTATION FOR FREE SURFACE FLOW PROBLEMS
P. Richard Zarda and Melvin S. Marcus Aug. 1978 38 p refs Presented at the 6th NASTRAN Users' Colloq.: Cleveland, 4-6 Oct. 1977
(Z0140201; SR0140301)
(AD-A057260; DTNSRDC-78/065) Avail: NTIS HC A03/MF A01 CSCL 20/4

This paper presents a procedure for using NASTRAN to determine the flow field about arbitrarily shaped bodies in the presence of a free surface. The fundamental unknown of the problem is the velocity potential which must satisfy Laplace's equation in the fluid region. Boundary conditions on the free surface may involve second order derivatives in space and time. In cases involving infinite domains either a tractable radiation condition is applied at a truncated boundary or a series expansion is used and matched to the local finite elements. Solutions are presented for harmonic, transient, and steady state problems and compared to either exact solutions or other numerical solutions. Author (GRA)

N79-11355# Naval Postgraduate School, Monterey, Calif.
DEVELOPMENT OF A METHOD FOR MEASURING VELOCITY AT THE EXIT OF A COMPRESSOR ROTOR USING KULITE PROBES WITH SYNCHRONIZED SAMPLING M.S. Thesis
Keith Allen Winters Mar. 1978 121 p refs
(AD-A057342) Avail: NTIS HC A06/MF A01 CSCL 13/7

Initial steps are reported in the development of a method

for determining the instantaneous velocity vector at the exit of a compressor rotor using two Kulite pressure probes with synchronized sampling. A method to determine the yaw angle of the flow at any point in the reference frame of the rotor using a single cylindrical Kulite impact probe and an equivalent pneumatic probe is described. The method was verified in the steady flow of a free jet and applied in the unsteady flow field of the compressor. On-line calibration of the Kulite probe with reference to the pneumatic probe was essential to the success of the method. Results for the distribution of the yaw angle peripherally across the exit of chosen pairs of rotor blade passages, are given. The analytical approximation of impact probe characteristics, on which the method is based, and its application with experimental data are described. Author (GRA)

N79-11356# California Univ., Berkeley. Lawrence Berkeley Lab.
TURBULENT HEAT TRANSPORT IN TWO-AND THREE-DIMENSIONAL TEMPERATURE FIELDS Ph.D. Thesis - London Univ.
Don S. Abesiri Samaraweera Mar. 1978 390 p refs
(Contract W-7405-eng-48)
(LBL-6890) Avail: NTIS HC A17/MF A01

Turbulent heat and mass transport processes in two- and three-dimensional convective flows are presented. The model of turbulence employed is the type referred to as a second-order closure. Parallel ideas were utilised in obtaining a model for turbulent heat and mass transfer processes. The problem of nonaxisymmetric convective heat and mass transport in pipes, which arises when the boundary conditions are not axisymmetric is studied. To expand the available data base an experiment was conducted to obtain heat transfer measurements in strong three-dimensional heating conditions. Numerical procedures especially suitable for incorporation of second-order turbulent closure models were developed. The effect of circumferential conduction in the tube material, which is influential in the asymmetric heating data currently available, was accounted for directly by extending the finite difference calculations into the pipe wall. DOE

N79-11357# Sandia Labs., Albuquerque, N. Mex.
EXACT AND APPROXIMATE SOLUTIONS OF THE INVISCID SHOCK LAYER FLOW WITH AN IMPLICIT FINITE-DIFFERENCE SCHEME
F. G. Blottner Jun. 1978 46 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0896) Avail: NTIS HC A03/MF A01

The Euler equations for a perfect gas are formulated in terms of a surface coordinate system with the four dependent variables u,v,p, and T. The governing equations are written in a form where the equations for conical flow, steady two-dimensional flow, or unsteady two-dimensional flow are readily obtained. The steady equations for supersonic flow are solved with a mid-point implicit scheme. Conical flow solutions are calculated or a marching procedure is used to obtain the shock layer flow along smooth pointed bodies. Numerical results for inviscid flow on a ogive are compared with experimental results and with simplified governing equations which use thin shock layer and parabolic equation approximations. DOE

N79-11358# Argonne National Lab., Ill.
COUPLED HYDRODYNAMIC-STRUCTURAL RESPONSE ANALYSIS OF PIPING SYSTEMS
M. T. A-Moneim Feb. 1978 88 p refs
(Contract W-31-109-eng-38)
(ANL-77-91) Avail: NTIS HC A05/MF A01

The expansion of the ICEPEL code for the coupled hydrodynamic-structural response analysis of pipe-elbow loops to general piping systems is described. A generalized piping component model, a branching tee junction, and a surge tank model were introduced and coupled with the pipe-elbow loop model so that a general piping system under the effect of internally traveling pressure pulses can be analyzed hydrodynamically, as well as structurally. Optional capabilities were included in the generalized piping component model so that it can be used in modeling pipe flow area changes, valves, and heat exchangers. The options were: nine different axisymmetric exterior wall configurations, elastic-plastic exterior walls, interior rigid-wall simulation, and heat exchanger tube-bundle model. The implicit continuous-fluid Eulerian (ICE) differencing technique was used in the hydrodynamic part of the analysis; the waves in hysteretic arbitrary media finite element scheme was used in the structural response part of the analysis. DOE

N79-11359# Union Carbide Corp., Oak Ridge, Tenn. Computer Sciences Div.
FLOWPLOT: A FLUID DYNAMICS AND HEAT TRANSFER PLOTTING PACKAGE
D. C. Elrod and J. N. Tunstall Mar. 1978 61 p refs
(Contract W-7405-eng-26)
(K/CSD/TM-22) Avail: NTIS HC A04/MF A01

The FLOWPLOT plotting program may be used with numerical fluid dynamics (or heat transfer with convection) codes to create velocity vector plots and/or contour plots of up to three fluid parameters (e.g. pressure, density, and temperature). The FLOWPLOT program reads a data set created by the user's fluid dynamics code. This data set must contain parametric data at every nodal point of a rectangular grid. The Display Integrated Software System and Plotting Language (DISSPLA) is used giving, the option of creating the plot data set on CALCOMP tape or creating a compressed plot data set that may be input to the DISSPLA postprocessor. This program has been stored on disk at ORGDP on the IBM 360/370 computing system. DOE

N79-11360# Argonne National Lab., Ill. Components Technology Div.
THERMODYNAMIC THEORY OF CAVITATION NUCLEI IN DILUTE LIQUID-GAS SOLUTIONS
Y. S. Cha Jun. 1978 39 p refs
(Contract W-31-109-eng-38)
(ANL-CT-78-33) Avail: NTIS HC A03/MF A01

The stability of a spherical bubble in a two-component two phase system is examined by employing the thermodynamic theory of dilute solutions. It is shown that a bubble can remain in a state of stable equilibrium provided that the ratio of the total number of moles of the solute to the total number of moles of the solvent in the system is not extremely small and that the system pressure falls between an upper bound (dissolution limit) and a lower bound(cavitation limit). The results of the analysis provide a theoretical basis for the persistence of microbubbles in a saturated liquid gas solution. Thus to a certain extent, the results also help to resolve the dilemma that exists in the field of cavitation due to (1) the necessity of postulating the existence of microbubbles; and (2)the lack of theoretical justification for the persistence of such bubbles in a liquid. DOE

N79-11361# European Space Agency, Paris (France).
PRESSURE PROFILE IN AN OPEN CAVITY WITH LINEARLY INCREASING OUTSIDE PRESSURE
Hans Hamacher Sep. 1978 41 p refs Transl. into ENGLISH of 'Druckverlauf in einem geoeffneten Hohlraum bei linear ansteigendem Aussendruck', DFVLR, Cologne Report DLR-FB-77-53, 7 Dec. 1977 Original report in GERMAN previously announced as N78-31400 Original German report available from DFVLR, Cologne DM 19.40
(ESA-TT-510; DLR-FB-77-53) Avail: NTIS HC A03/MF A01

A method is described for calculating the pressure profile in a cavity connected by an opening to an environment in which the pressure is increasing linearly. The following conditions were assumed: constant volume, no gas sources inside the cavity, the same gases inside and outside the cavity, and equal pressures at the start. Calculations were performed for both the adiabatic and isothermal changes of state, taking into account in first approximation the gas friction inside the opening. The solutions depend on two parameters. All necessary functions are given in the form of diagrams. The measured pressure functions obtained for an approximately 3 liter vessel are compared with theoretical results. Author (ESA)

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N79-11362 Rochester Univ., N. Y.
FAR-FIELD HOLOGRAPHY: A REASSESSMENT AND NEW APPLICATIONS Ph.D. Thesis
Glenn Anthony Tyler 1978 157 p
Avail: Univ. Microfilms Order No. 7818294

The theoretical formulation of the formation and reconstruction of far-field holograms presented from a diffraction theory point of view and the application of the knowledge gained in the experimental realization of workable systems capable of analyzing particles in the 2-200 micron range are presented. A concept of image matrix is introduced and shown to be consistent with a vector description of the far-field holographic process. This detailed analysis of the far-field holographic process is utilized in the development of new and useful ways to analyze the size and shape of small particles. High resolution imaging of pollen grains and red blood cells is also discussed. Dissert. Abstr.

N79-11363 British Broadcasting Corp., Kingswood (England). Engineering Div.
AN ERROR-CORRECTING SYSTEM FOR A MULTI-CHANNEL DIGITAL SOUND RECORDER
F. A. Bellis Sep. 1978 8 p refs
(BBC-RD-1978/28) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The development of a single track per channel error-correcting scheme for a digital sound recorder is traced. The use of data reordering as a technique for turning burst errors into single bit errors is discussed, and the performance is shown to be inadequate, when associated with sample repetition for concealment. Error correcting codes are dealt with, using cyclic redundancy code (CRC). The development of a single track per channel system from a three track per channel system using a CRC is outlined, and the parameters of a recorder using this scheme are given. The length of drop-out that can be withstood on the single track is longer than any likely to be encountered. G.Y.

N79-11364*# National Aeronautics and Space Administration, Washington, D. C.
SYSTEM OF PROGRAMMED MODULES FOR MEASURING PHOTOGRAPHS WITH A GAMMA-TELESCOPE
S. A. Averin, G. V. Veselova, and G. V. Navasardyan Oct. 1978 27 p refs Transl. into ENGLISH of "Sistema Programmnykh Moduley Dlya Izmereniya Snimkov s Gamma-teleskopa", Rept. PR-386 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-27 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75560; PR-386) Avail: NTIS HC A03/MF A01 CSCL 14E

Physical experiments using tracking cameras resulted in hundreds of thousands of stereo photographs of events being received. To process such a large volume of information, automatic and semiautomatic measuring systems are required. At the Institute of Space Research of the Academy of Science of the USSR, a system for processing film information from the spark gamma-telescope was developed. The system is based on a BPS-75 projector in line with the minicomputer Elektronika 1001. The report describes this system. The various computer programs available to the operators are discussed. G.Y.

N79-11365*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ANALYTICAL MODELS AND SYSTEM TOPOLOGIES FOR REMOTE MULTISPECTRAL DATA ACQUISITION AND CLASSIFICATION
Friedrich O. Huck, Stephen K. Park, Ernest E. Burcher, and W. Lane Kelly, IV Aug. 1978 39 p refs
(NASA-TM-78795) Avail: NTIS HC A03/MF A01 CSCL 14B

Simple analytical models are presented of the radiometric and statistical processes that are involved in multispectral data acquisition and classification. Also presented are basic system topologies which combine remote sensing with data classification. These models and topologies offer a preliminary but systematic step towards the use of computer simulations to analyze remote multispectral data acquisition and classification systems. Author

N79-11366*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ACOUSTIC HOLOGRAPHY: PROBLEMS ASSOCIATED WITH CONSTRUCTION AND RECONSTRUCTION TECHNIQUES
Jag J. Singh Sep. 1978 24 p refs
(NASA-TM-78797) Avail: NTIS HC A02/MF A01 CSCL 14E

The implications of the difference between the inspecting and interrogating radiations are discussed. For real-time, distortionless, sound viewing, it is recommended that infrared radiation of wavelength comparable to the inspecting sound waves be used. The infrared images can be viewed with (IR visible) converter phosphors. The real-time display of the visible image of the acoustically-inspected object at low sound levels such as are used in medical diagnosis is evaluated. In this connection attention is drawn to the need for a phosphor screen which is such that its optical transmission at any point is directly related to the incident electron beam intensity at that point. Such a screen, coupled with an acoustical camera, can enable instantaneous sound wave reconstruction. L.S.

N79-11367*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
AN ULTRASONIC FLOWMETER FOR MEASURING DYNAMIC LIQUID FLOW
T. D. Carpini and J. H. Monteith Oct. 1978 53 p refs
(NASA-TM-78798) Avail: NTIS HC A04/MF A01 CSCL 14B

A novel oscillating pipe system was developed to provide dynamic calibration wherein small sinusoidal signals with amplitudes of 0.5 to 10% of the steady-state flow were added to the steady-state flow by oscillating the flowmeter relative to the fixed pipes in the flow system. Excellent agreement was obtained between the dynamic velocities derived from an accelerometer mounted on the oscillating pipe system and those sensed by the flowmeter at frequencies of 7, 19, and 30 Hz. Also described were the signal processing techniques used to retrieve the small sinusoidal signals which were obscured by the fluid turbulence. L.S.

N79-11368# Army Engineer Topographic Labs., Fort Belvoir, Va. Computer Sciences Lab.
AN EVALUATION OF THE METHOD OF DETERMINING PARALLAX FROM MEASURED PHASE DIFFERENCES
Michael A. Crombie and Robert S. Rand Dec. 1977 33 p
(AD-A056006; ETL-0145) Avail: NTIS HC A03/MF A01 CSCL 14/5

The practicality of determining parallax by means of detecting phase differences extracted from corresponding epipolar scans was evaluated using a digitized aerial image. The method was found to be not as accurate and not as efficient as conventional image matching techniques. Author (GRA)

N79-11369# Aerodyne Research, Inc., Bedford, Mass. Advanced Development Div.
DEGRADATION TEST MATERIALS Final Report, 14 Nov. 1975 - Jun 1977
Gershon M. Goldberg 15 Oct. 1977 49 p
(Contract F33615-76-C-1179)
(AD-A056083; ARI-ADD-77-3; AFAL-TR-77-197) Avail: NTIS HC A02/MF A01 CSCL 14/5

Two materials have been developed for testing of film transport mechanisms to detect malfunctions likely to damage photographic films. One material is intended for dry applications only, the other for applications where there is contact with aqueous solutions. The designations 'wet' and 'dry' degradation test material (DTM) have been applied to differentiate between the two. The dry DTM, a coating of solvent-filled microcapsules in a gelatin/polyvinyl alcohol matrix on a black base, produces a

contrasing white mark at the site of a scratch or abrasion. The wet DTM, a coating of empty microcapsules in a similar matrix, has a white surface covering the black base. Damage to this DTM causes localized removal of the white coating to reveal the black background. Versions of both DTMs have been produced on a flashbed, processed Estar-based film substrate. The major part of the program described in this report was an attempt to provide a wet DTM on a dyed black polyester substrate. Satisfactory results were not obtained because coatings either lost much of their contrast after contacting aqueous solutions or had poor wet rub resistance. Formulations having good wet rub resistance showed excessive contrast loss while formulations retaining their contrast had poor wet rub resistance.
Author (GRA)

N79-11370# Michigan State Univ., East Lansing. Div. of Engineering Research.
OPTICAL GAGE FOR STRAIN/DISPLACEMENT MEASUREMENT AT HIGH TEMPERATURE NEAR FATIGUE CRACK TIPS Final Technical Report, 1 Jan. 1976 - 31 Jul. 1977
William N. Sharpe, Jr. and Donald R. Martin Sep. 1977 137 p refs
(Contract F33615-76-C-5059; AF Proj. 2307)
(AD-A057664; AFML-TR-77-153) Avail: NTIS HC A07/MF A01 CSCL 11/6

The interferometric strain/displacement gage (ISDG) relates the motion of fringe patterns generated by a laser beam impinging upon closely-spaced indentations to local surface deformation. The purpose of this research was to extend the technique to real-time crack tip opening displacement (CTOD) and biaxial strain measurements on superalloys at high temperatures. The indentations must remain reflective at temperature; they can be protected with a coating. A coating was developed to protect Incolloy 901 for several hours at 650 C. IN-100 will remain reflective if it is preoxidized in an rf furnace, but an electroplated chromium and vapor-plated platinum coating produces better fringe patterns. GRA

N79-11371# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
FLASH RADIOGRAPHY IN BALLISTIC TESTING Final Test Operations Procedure
8 Jun. 1978 16 p Supersedes MTP-4-2-825
(AD-A057390; TOP-4-2-825; MTP-4-2-825) Avail: NTIS HC A02/MF A01 CSCL 19/4

Provides procedures for use of high-speed flash radiographic equipment to obtain shadowgraphs of radiographs of projectile performance in-bore, at the muzzle, in flight, or upon impact with target. Describes equipment, test setup, safety precautions, advantages and limitations. Author (GRA)

N79-11372# Liquid Metal Engineering Center, Canoga Park, Calif.
EVALUATION OF CHROMEL-ALUMEL THERMOCOUPLE WIRES PERCUSSION WELDED TO 2 1/4 % CHROMIUM - 1% MOLYBDENUM
W. E. Burns and E. G. Thompson 30 Mar. 1978 10 p refs
(Contract EY-76-C-03-0700)
(LMEC-TDR-78-7) Avail: NTIS HC A02/MF A01

A special adaptation of capacitance discharge welding called percussion welding was evaluated for the attachment of chromel/alumel thermocouples to the bottom of small diameter holes up to 1' deep in 2 1/4% chromium 1% molybdenum alloy steel. Weld attachments were examined for quality, cracking, and heat treat effects on the alloy steel. Sample thermocouples were fabricated using the method and calibrated in freezing point of pure metal standards to determine the expected accuracy of the temperature measurements when this procedure is used. DOE

N79-11373# California Univ., Livermore. Lawrence Livermore Lab.
CAPABILITIES FOR MEASURING PHYSICOCHEMICAL PROPERTIES AT HIGH PRESSURE
H. C. Heard and A. Duba 9 Feb. 1978 46 p refs
(Contract W-7405-eng-48)
(UCRL-52420) Avail: NTIS HC A03/MF A01

A group of high-pressure systems that measure physicochemical properties of various media up to 2000 C and 30 GPa is described. With these systems it is possible to determine complete stress-strain behavior, ultrasonic velocities, permeability, phase studies, fracture-flow behavior, and optical and electrical properties. The apparatus is described in terms of published results, photographs, and schematic diagrams. DOE

36 LASERS AND MASERS

Includes parametric amplifiers.

N79-11374 Princeton Univ., N. J.
A STUDY OF AN ELECTRIC DISCHARGE IN A SUPERSONIC NITROGEN STREAM Ph.D. Thesis
Manuel Garcia 1978 236 p
Avail: Univ. Microfilms Order No. 7818336

The results of experimental and theoretical studies of a supersonic channel containing a transverse, plate discharge and localized pin discharge ionizers are presented. The purpose of this research was to determine the mechanisms by which plasma is created and distributed in a discharge channel of this type. The conditions desired for laser applications have been partially achieved in the present experiment, however, the electron number density is low by an order of magnitude (n sub e approx. equal to 10 to the 10th power/cu cm), the control of n sub e and epsilon remains strongly coupled and the plasma produced is not homogeneously distributed. Spatially resolved measurements of neutral density, flow velocity, voltage distribution between the discharge plates and plasma density distributions have allowed for the determination of important plasma properties such as the ratio of electric field to total number density, the ambipolar diffusion coefficient and the average electron energy.
Dissert. Abstr.

N79-11375 Yale Univ., New Haven, Conn.
TIME INTERVAL MEASUREMENTS USING MODE LOCKED LASERS Ph.D. Thesis
Donald Barry Carlin 1977 104 p
Avail: Univ. Microfilms Order No. 7818078

Techniques for the measurement of sub-nanosecond time intervals were developed. An optical sampling system, having picosecond resolution was devised for second order intensity correlation measurements of mode locked laser pulses based on the two-quantum photoelectric effect. Properties of the second order correlation functions of mode locked light were investigated. A mode locked, cavity dumped argon ion laser, capable of 100 W peak power, 125 ps duration, single pulse output was developed. A method for the determination of fast relaxation rates by time-dependent gain or absorption measurements using optical excitation and optical sampling was developed. The technique was applied to an attempt to determine the lifetime of lower state of the argon ion laser. A measurement of a fast relaxation process in sodium salicylate, occurring with a lifetime of approximately 630 ps, was made using this method.
Dissert. Abstr.

N79-11376# Air Force Academy, Colo.
STUDIES OF O2(1) DELTA SUB g PRODUCTION AND DEACTIVATION Progress Report, 1 Nov. 1976 - 30 Nov. 1977
Larry P. Davis and Chester J. Dymek May 1978 25 p refs
(AD-A057351; FJSRL-TR-78-0001) Avail: NTIS HC A02/MF A01 CSCL 20/5

Production and deactivation of singlet delta oxygen has been measured with electron spin resonance spectroscopy. Microwave discharge and chemical reactions were used to produce the excited oxygen. Deactivation rate measurements of the excited oxygen by self- and wall collisions as well as with gaseous chlorine have been accomplished. Results indicate insignificant deactivation by chlorine. Author (GRA)

N79-11377# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
ANALYSIS AND DESIGN MODIFICATION OF AN AIRBORNE MIRROR ALIGNMENT SYSTEM M.S. Thesis
Patrick D. Nutz Mar. 1978 119 p refs

(AD-A056093; AFIT/GAE/AA/78M-12) Avail: NTIS HC A06/MF A01 CSCL 20/6

This study deals with an electronic control system modification to solve a torque limitation problem in the Airborne Dynamic Alignment System aboard the Airborne Laser Lab. This control system is reduced in complexity and modeled in the frequency and state space domains. Closed loop system response over a desired frequency range is obtained from the frequency domain model. Stability data is calculated through eigenvalue analysis of the state space model. A low pass filter is introduced to decrease the demand on the torque saturated motor. The main result of this modification is that the filter does not appreciably alter the closed loop response. This is due to the fact that the cutoff frequency of the filter must be extremely high to keep the modified system stable. It is concluded that the complimentary filter does not solve the torque saturation problem. A recommendation is made that further analysis be concentrated in the time domain through modern state space techniques and the design approach to an optimal controller is presented. Author (GRA)

N79-11378# Ohio State Univ., Columbus. Electroscience Lab.

LASER ATMOSPHERIC ABSORPTION STUDIES Final Technical Reports, Jul. 1975 - Sep. 1977

R. K. Long, E. K. Damon, R. J. Nordstrom, J. C. Peterson, and M. E. Thomas Jun. 1978 129 p refs

(Contract F30602-76-C-0058; ARPA Order 1279)

(AD-A056044; ESL-4232-6; RADC-TR-78-124) Avail: NTIS HC A07/MF A01 CSCL 20/5

Measurements of water vapor absorption coefficients for 27 CO2 laser lines are given. Some measurements were obtained using a spectrophone and others using a long path absorption cell. Measurements were made with pure water vapor, and with samples broadened with N2 and with O2-N2 mixtures. This is discussed in Section I and Tables II and IV summarize the results obtained. Studies of water vapor absorption by CO laser radiation were also conducted. This is discussed in Section II and the results are summarized in Table V. A new long path White cell was developed under this program. A brief description of this equipment is given in Section III. A small cw HF/DF chemical laser also was developed. The results obtained are described in Section IV. GRA

N79-11379# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

SPATIAL FILTERING DESIGN CONSIDERATIONS FOR A LASER LINE SCANNING SENSOR M.S. Thesis

William D. Strautman Dec. 1977 60 p refs

(AD-A056503; AFIT/GEO/EE/77-6) Avail: NTIS HC A04/MF A01 CSCL 20/5

The performance of an airborne laser terrain mapper, which collects slant range and reflectance data simultaneously, is determined in part by the spatial filtering effects of the finite laser beam spot size. An analysis of the spatial filtering effects and the resulting distortion of the terrain profile slant range to the aircraft is made to interpret the interaction between the terrain characteristics and the resulting laser line scan information. Emphasis is placed on the range interactions. In particular, the terrain height profile is modeled as a single sinusoid in one spatial dimension with constant reflectivity. The laser transmitter is sinusoidally intensity modulated, so that the received signal is subcarrier phase modulated by the terrain height profile. This phase modulated signal is low pass filtered to represent the effects of the spatial filter. Numerical analysis is utilized to evaluate this nonlinear filtering problem and to examine the range error in terms of the maximum range height variations. The resulting mean-squared range distortion error is added to the range squared distortion error originating from the receiver noise in the Phase Locked Loop phase tracking circuit. The distortion due to spatial filtering is shown to increase with the laser modulation frequency while the errors due to detection noise decrease with frequency. GRA

N79-11380# Aerospace Corp., El Segundo, Calif. Aerophysics Lab.

A REVIEW OF RATE COEFFICIENTS IN THE H2-F2 CHEMICAL LASER SYSTEM: SUPPLEMENT, 1977 Interim Report

Norman Cohen 8 Jun. 1978 41 p refs

(Contract F04701-77-C-0078)

(AD-A056281; TR-0078(3603)-4; SAMSO-TR-78-41) Avail: NTIS HC A03/MF A01 CSCL 20/5

This report reviews the literature published since the last report covering this subject appeared: 'A Review of Rate Coefficients in the H2-F2 Chemical Laser System,' N. Cohen and J. F. Bott. Published rate data are summarized and evaluated; a list of 'best' estimates of rate coefficients is presented. GRA

N79-11381# Harvard Univ., Cambridge, Mass. Div. of Applied Sciences.

A FAR-INFRARED LASER STUDY OF JOSEPHSON POINT CONTACTS

David Allan Weitz May 1978 153 p refs

(Contracts N00014-77-C-0085; N00014-75-C-0648; Grant NSF DMR-76-11323)

(AD-A056277; TR-14) Avail: NTIS HC A08/MF A01 CSCL 20/12

The high-frequency behavior of niobium cat-whisker point contacts is studied using radiation from an optically pumped far-infrared (FIR) laser. The FIR molecular laser had a dielectric-waveguide cavity and was pumped by a CO2 laser. The use of capacitive-mesh output couplers is extended throughout the FIR spectrum, between 42 micrometers and 1.2 mm, and have found the optimum grid constants for several lines. At shorter wavelengths, the laser performance was improved by the use of a novel hybrid capacitive-mesh hole output coupler. The coupling of the FIR radiation to the point contact is found to depend in a simple manner on the resistance of the contact. The FIR laser radiation induces constant-voltage steps on the dc I-V curves of the junctions, allowing the high-frequency ac Josephson effect to be studied. GRA

N79-11382# Scott Polar Research Inst., Cambridge (England).

AN INTERACTIVE GRAPHICS SYSTEM FOR THE REDUCTION OF AIRBORNE LASER PROFILES OF SEA ICE

I. J. J. Holyer, Peter Wadhams, and R. T. Lowry 1977 29 p refs

(Contract N00014-76-C-0660)

(AD-A057464; SPRI-TR-77-1) Avail: NTIS HC A03/MF A01 CSCL 09/2

The authors have developed an interactive graphics system for the correction and reduction of airborne laser profiles of sea ice. The system is implemented on a Vector General Renewable display system connected to a PDP 11/45 computer, but minor modifications would make it suitable for any computer with interactive graphics. The laser profile is displayed in sections and the human operator is armed with routines for the removal of noise spikes, phase jumps and aircraft altitude variations. Completely automatic profile correction techniques have been found to be inadequate or unworkable, especially in heavily ridged ice. Although designed specifically to treat the output of the Geodolite laser profilometer, the system can be applied to many other data correction problems in geophysics and other sciences where long time series of data are obtained with periodic noise spikes or a long-period drift or modulation which requires removal. Author (GRA)

N79-11383# Illinois Univ. at Urbana-Champaign, Urbana. Electro-Physics Lab.

OPTICALLY PUMPED FAR INFRARED LASERS Final Report, 1 Mar. 1975 - Feb. 1978

T. A. DeTemple and P. D. Coleman Jun. 1978 57 p refs

(Grant DAHC04-75-G-0099)

(AD-A055998; UILU-ENG-78-2543) Avail: NTIS HC A04/MF A01 CSCL 20/5

Experiments and theory regarding the emission processes in optically pumped far infrared laser sources are reported. Super-radiance from CH3F at 496 micrometers in the homogeneously broadened regime has been identified for the first time. Stimulated Raman emission on pure rotational transitions in D2O at 50 micrometers and 66 micrometers has also been identified for the first time. Generally good agreement between experiments and a Maxwell-Bloch approach was obtained for the superradiance study, and good qualitative agreement between experiments and a Maxwell-density matrix approach using three waves interacting in a four-level system was noted for the Raman study; both

implying that the processes are now resaonable well characterized and understood. Author (GRA)

N79-11384# Army Materiel Test and Evaluation Directorate, White Sands Missile Range, N. Mex.
APPLICATIONS FOR A GATED IMAGING SYSTEM IN EVALUATION OF LASER DESIGNATOR PERFORMANCE
William E. Shaw Jun. 1978 13 p
(AD-A056487) Avail: NTIS HC A02/MF A01 CSCL 20/5

In the early 1970's the Army Materiel Test and Evaluation Directorate, White Sands Missile Range, undertook a multi-year test methodology development program to perfect techniques and develop hardware required to evaluate an anticipated family of Army Laser Designators. Standard laboratory test instruments and procedures were readily available; however, the more complex problems of energy distribution within the laser beam were not resolved. A concurrent development, at this point, was a shift toward acquiring data, wherever possible, in an image format, and subsequently processing the data on a large-scale digital computer. These two ideas led to the development and subsequent procurement of a data acquisition system known as the Laser Spot Scanning System or LS3. The LS3 is a gated, image-intensified silicon vidicon camera with a standard S-1 response. The camera is equipped with a 1.06 micron spike filter mounted on a 15 mm to 150 mm zoom lens. Mounted on top of the camera's environmental container is a YAG 444 series photo-diode with associated optics. The photo-diode controls the gating function of the camera. Control of the camera is remoted, and the output recorded on a standard video tape recorder and/or displayed on a standard closed circuit television monitor. GRA

N79-11385# National Bureau of Standards, Washington, D. C. Ceramics Glass and Solid State Science Div.
OPTICAL MATERIALS CHARACTERIZATION Technical Report, 1 Aug. 1977 - 31 Jan. 1978
Albert Feldman, Deane Horowitz, Roy M. Waxler, and Marilyn J. Dodge May 1978 23 p refs
(ARPA Order 2620)
(AD-A056197; NBSIR-78-1473) Avail: NTIS HC A02/MF A01 CSCL 20/5

The piezo-optic constants of CaF2, BaF2, and SrF2 have been measured at 0.6328 micrometers and 1.15 micrometers. The temperature dependence of the refractive indices of CdF2, MgF2, and NaCl have been measured at several wavelengths in the infrared by the method of Fizeau interferometry. The linear thermal expansion coefficients of NaCl and CdF2 as a function of temperature have also been measured. Author (GRA)

N79-11386# Naval Research Lab., Washington, D. C.
THEORY OF ELECTRON CYCLOTRON MASER INTERACTIONS IN A CAVITY AT THE HARMONIC FREQUENCIES Interim Report
K. R. Chu Apr. 1978 38 p refs
(AD-A057686; AD-E000181; NRL-MR-3672) Avail: NTIS HC A03/MF A01 CSCL 20/5

A theory of the cyclotron maser interactions between an annular electron beam and the standing electromagnetic wave in a cavity structure is formulated on the basis of the relativistic Vlasov equation and the Maxwell equations. Detailed analytical expressions for the beam-wave coupling coefficient, beam energy gain, and threshold beam power have been derived for the fundamental and higher cyclotron harmonics. Physical interpretations of these results and comparison with cyclotron maser interactions in a waveguide structure will be presented. Methods of parameter optimization and their applications to experiments will be illustrated through numerical examples. Author (GRA)

N79-11387# Los Alamos Scientific Lab., N. Mex.
DESIGN OF THE ENERGY STORAGE SYSTEM FOR THE HIGH ENERGY GAS LASER FACILITY AT LASL
K. B. Riepe and M. J. Kircher 1977 12 p Presented at 7th Symp. on Fusion Research Proj., Knoxville, Tenn., 25 Oct. 1977
(Contract W-7405-eng-36)
(LA-UR-77-2419; Conf-771029-37) Avail: NTIS HC A02/MF A01

The Antares laser is being built in the High Energy Gas Laser Facility (HEGLF) at Los Alamos to continue laser fusion experiments at very high power. The laser medium will be pumped by an electrical discharge, which requires an energy input of about 5 MJ in a few microseconds at about 500 kV. The energy storage system which will provide the pulsed power will be a bank of high-voltage pulse-forming networks. Tradeoff studies were performed comparing the performance of multi-mesh networks with single-mesh networks. A prototype pulse-forming network is being built to test components and trigger performance. It is a Marx generator storing 300 kJ at 1.2 MV open circuit, with 3 microns H internal inductance. DOE

N79-11388# Los Alamos Scientific Lab., N. Mex.
DAMAGE RESISTANCE OF AR-COATED GERMANIUM SURFACES FOR NANOSECOND CO2 LASER PULSES
B. E. Newman and D. H. Gill 1977 19 p Presented at Symp. on Optical Materials for High Power Lasers, Boulder, Colorado, 4 Oct. 1977
(Contract W-7405-eng-36)
(LA-UR-77-2530; Conf-771061-2) Avail: NTIS HC A02/MF A01

An evaluation of the state-of-the-art of AR coatings on galium doped germanium, used as a saturable absorber at 10.6 micrometers, was conducted. Both 1-on-1 and N-on-1 laser damage thresholds were measured with 1.2 ns pulses on bare and coated surfaces. Only front surface damage was observed. With few exceptions, the thresholds for coated surfaces were centered at 0.49 +-0/3J/sq. cm. Bare Ge had a threshold ranging from 0.65 to 0.70 J/sq. cm. No significant differences due to substrate polish, crystallinity or doping level were evident and multiple-shot conditioning resulted in the same threshold as for single shot tests. From an analysis of standing wave electric fields, damage for AR coated Ge appeared to be limited by the surface properties of Ge. Measurements at both 1.2 and 70 ns indicated that the threshold (J/sq cm) of both coated and uncoated Ge increases as the square root of the pulse width. DOE

N79-11389# California Univ., Livermore. Lawrence Livermore Lab.
FABRICATION OF CRYOGENIC LASER FUSION TARGETS
R. L. Woerner and C. D. Hendricks Sep. 1977 6 p Presented at Topical Meeting on Inertial Confinement Fusion, San Diego, Calif.
(Contract W-7405-eng-48)
(UCRL-79442; Conf-780202-7) Avail: NTIS HC A02/MF A01

Two novel techniques which produce a uniform frozen layer of deuterium-tritium on the inside surface of a glass microsphere are presented. DOE

N79-11390# California Univ., Livermore. Lawrence Livermore Lab.
NUMERICAL METHODS FOR LASER FUSION
G. B. Zimmerman 3 Nov. 1977 7 p Presented at Analysis of Nucl. Systems, Tucson, Ariz., 28 Mar. 1977
(Contract W-7405-eng-48)
(UCRL-78794; Conf-770304-16) Avail: NTIS HC A02/MF A01

The LASNEX computer code was developed to study the many interrelated physical processes important in the effort to achieve laser initiated fusion. It was used to calculate the results of numerous laser plasma experiments and to design targets and determine desirable laser pulse characteristics. Some processes, such as hydrodynamics, are formulated in fundamental equations and can be solved with high accuracy by sophisticated numerical methods. Other processes, such as laser absorption and electron transport, are less well understood and do not, in general, warrant the use of highly accurate techniques. Numerical models were chosen that adequately represent each physical process, keeping in mind its inherent uncertainties, the importance of the process to the overall calculation, and its effect on the determination of experimental observables. DOE

N79-11391# Los Alamos Scientific Lab., N. Mex.
DAMAGE RESISTANCE OF COATED OPTICS FOR PULSED CO2 LASERS
B. E. Newnam 1978 18 p refs Presented at SPIE '78 Seminars, Wash., D. C., 28 Mar. 1978
(Contract W-7405-eng-36)

(LA-UR-78-931; Conf-780324-5) Avail: NTIS HC A02/MF A01

The influence of various factors on the damage threshold of coated optical components used in high-power, pulsed CO2 lasers is reviewed. The factors considered are substrate roughness and polishing defects, coating defects, linear absorption, deposition parameters, standing-wave electric fields, pulsewidth dependence, multiple-shot conditioning, and optical performance. Experimental results of many researchers are used to illustrate the discussions. DOE

N79-11392# California Univ., Livermore. Lawrence Livermore Lab.

MEASUREMENT AND IDENTIFICATION OF LASER-DAMAGE THRESHOLDS IN THIN FILMS

D. Milam Mar. 1978 11 p refs Presented at SPIE Tech. Symp. East, Wash. D.C., 28 Mar. 1978

(Contract W-7405-eng-48)

(UCRL-80629) Avail: NTIS HC A02/MF A01

The source and magnitude of uncertainties in the measurement of practical laser-damage thresholds are discussed. Damage is defined to be a permanently induced change in a bare or coated optical surface which degrades the merit of the surface with regard to specifications such as scattering, reflection, or transmission. Bulk damage is not treated, and the discussion is limited to tests conducted with laser pulses having wavelengths of 694 nm or 1064 nm and durations less than 100 ns. The measurement of pulse energy, the spatial and temporal profile of the pulse, and determination of the occurrence of damage are described in detail. It is shown that the uncertainty in the measurement of absolute laser-damage thresholds can be as small as 10% and that, within such limits, there is no site-to-site variation of the threshold of optical surfaces. DOE

N79-11393# California Univ., Livermore. Lawrence Livermore Lab.

THEORETICAL STUDIES INVOLVING CANDIDATE VIA LASER SYSTEMS

C. Bender, A. Hazi, A. Orel, T. Rescigno, and N. Winter 5 Oct. 1977 7 p refs Presented at the Topical Meeting on Inertial Confinement Fusion, San Diego, Calif., 7-9 Feb. 1978

(Contract W-7405-eng-48)

(UCRL-80165; Conf-780202-22) Avail: NTIS HC A02/MF A01

Theoretical studies supporting the Livermore photolytic Group VIA laser project were initiated early in 1977. Results of numerous theoretical studies which deal with the photolysis process, losses in the upper laser level and the photolytic pumps are described. Results of ab initio calculations on OCS were used to assign the electronic states and to analyze the photolysis process. Photoionization cross sections of the upper laser level were calculated for (O1S), S(1S) and Se(1S). Potential curves of S2(+) were determined in the search for possible quenching processes of the upper state potential energy curves of rare-gas excimer pumps and photoionization cross sections of the excimer states was determined. DOE

N79-11394# Los Alamos Scientific Lab., N. Mex.

DESIGN ENGINEERING OF LARGE HIGH-PRESSURE GAS LASER AMPLIFIERS

W. T. Leland 1978 17 p refs Presented at SPIE 1978 Seminars, Washington, D. C., 28 Mar. 1978

(Contract W-7405-eng-36)

(LA-UR-78-876; Conf-780324-3) Avail: NTIS HC A02/MF A01

The creation of a population inversion in large-volume high-pressure gas via an electrical discharge posed numerous engineering problems, not only concerning details of various components, but also in overall system performance or optimization. The Laser Division at Los Alamos has developed a base of engineering data and computational techniques which addresses the engineering design problems for our short-pulse, large and high-pressure CO2 amplifiers. The various aspects of the problem considered individually and in total are described. DOE

N79-11395# Washington Univ., Seattle.

CO2 LASER INTERACTION WITH MAGNETICALLY CONFINED PLASMAS Annual Report

G. C. Vlases and Z. A. Pietrzyk Aug. 1977 165 p refs

(Contract EY-76-S-06-2225-028)

(RLO-2225-T28-16) Avail: NTIS HC A08/MF A01

Two basic experimental configurations termed the slow (or steady) solenoid, and the fast solenoid are described. In the former, the field is essentially steady during the experiment lifetime, the gas (plasma) remains in contact with the wall, and all the heating is done by the laser. In the fast solenoid, the field rises on a timescale comparable to the laser pulse length, removing the plasma from the wall, and contributing to the plasma energy content via compression work. In the slow solenoid, preionization is generally not used, and the laser both creates the plasma and heats it. In the fast solenoid, the preionization technique is relatively critical as it must create conditions leading to a true particle minimum on axis in order to insure favorable refraction of the laser beam (trapping). DOE

N79-11396# California Univ., Livermore. Lawrence Livermore Lab.

OPTICAL COMPONENTS FOR THE SHIVA LASER

E. P. Wallerstein, F. T. Marchi, W. T. Whistler, and H. D. Bissinger 22 Dec. 1977 16 p refs Presented at the SPIE Conf., Los Angeles, 16-18 Jan. 1978

(Contract W-7405-eng-48)

(UCRL-79444; Conf-780140-1) Avail: NTIS HC A02/MF A01

SHIVA, the 10-kilojule Neodymium-glass laser is currently being applied to laser fusion experiments. In order to focus the energy on targets smaller than 1 mm in diameter, it is necessary to maintain very high optical quality throughout the system. The manufacturing and testing technologies involved in meeting this challenge were noteworthy and have encompassed glass manufacturing, optical finishing, and coating, for elements as diverse as Faraday rotators, laser rods and disks and aspheric lenses. DOE

N79-11397# Chalmers Univ. of Technology, Goteborg (Sweden). Research Lab. of Electro-Optics and Lasers.

TUNABLE LASER SPECTROSCOPY IN MINERAL PROSPECTING

S. T. Eng and E. Max 1977 7 p refs Submitted for publication Sponsored by Swed. Board for Tech. Develop.

(CTH-IEM-TR-7638) Avail: NTIS HC A02/MF A01

Laser spectroscopy is applied to measure very low gas concentrations that may be specific in association with metallic ore deposits. An experiment on SO2 is detailed. The experimental setup is detailed together with the associated electronics required to compute derivative spectra. Maximum sensitivity was shown to be around 10 ppm of SO2. The major sensitivity limitation identified to lie with dissimilarities between the reference and measurement cells - together with other necessary improvements are discussed. ESA

N79-11398# Max-Planck-Institut fuer Physik und Astrophysik, Garching (West Germany). Inst. fuer Extraterrestrische Physik.

OPTIMUM CONDITIONS FOR NONRESONANT THIRD HARMONIC GENERATION

Heinz Puell and Carl Rudolf Vidal Dec. 1977 65 p refs

(MPI-PAE/Extraterr-140) Avail: NTIS HC A04/MF A01

A detailed theoretical analysis of nonresonant third harmonic generation is given which includes the intensity dependent refractive indices of the nonlinear medium as an integral part. According to the third order analytic solution the maximum attainable conversion efficiency is limited only by a nonlinear parameter which is essentially the ratio of the Kerr-constants and the third harmonic coefficient. Only for values of this parameter lower than one intensity (energy) conversion efficiencies in excess of 90% (40%) are possible. The influence of the intensity distribution of the input beam is discussed. Diagrams are given from which the optimum experimental conditions can be deduced in order to get the optimum harmonic output. Limiting processes, such as 5th order effects or self-focusing are analyzed. As an example the optimum conditions for efficient frequency tripling of powerful Nd:glass laser radiation are evaluated. Author (ESA)

N79-11399# National Technical Information Service, Springfield, Va.

GAS DYNAMIC LASERS. A BIBLIOGRAPHY WITH

ABSTRACTS Progress Report, 1964 - Jul. 1978
Mona F. Smith Aug. 1978 244 p Supersedes NTIS/PS-77/0726; NTIS/PS-76/0620; NTIS/PS-75/573; NTIS/PS-75/018 (NTIS/PS-78/0829/8; NTIS/PS-77/0726; NTIS/PS-76/0620; NTIS/PS-75/573; NTIS/PS-75/018) Avail: NTIS HC $28.00/MF $28.00 CSCL 20E

The citations cover research on kinetic and energy transfer processes, design, optics, nozzles, and performance of gas and chemical lasers relying on gas dynamic effects for lasing enhancement. Diffusion and flow studies specifically applicable to such lasers are also included. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N79-11400 Texas Univ. at Austin.
EQUIVALENT LINEARIZATION MODELING APPLIED TO NONLINEAR DISTRIBUTED, DISCRETE PARAMETER DYNAMIC CABLE SYSTEMS Ph.D. Thesis
Robert Adalbert McLauchlan 1978 333 p
Avail: Univ. Microfilms Order No. 7817679

Two equal linearization models were developed to describe the one-dimensional, vertical motion of hybrid nonlinear dynamical systems which consist of distributed parameter cable segments and discrete payload bodies. These models assume taut cable systems of moored or free floating configuration. Single frequency and random surface excitation cases are considered in the two models. The constitutive relation for the fluid drag involves a drag coefficient, and the sign and the square of the relative velocity between the cable or the payload and the surrounding fluid. The models consider the depth or the length variation of the tangential drag coefficient of the cable segments. The cable drag coefficient is calculated as a function of the local cable Reynolds number. The payload drag and inertia coefficients are calculated as functions of the local payload Strouhal number. Excellent agreement can be obtained between measured and calculated values of dimensionless cable tension using four parameters--one for the cable drag coefficient, two for the payload drag coefficient, and one for the payload inertia coefficient.
Dissert. Abstr.

N79-11401 Alabama Univ., University.
OPTIMIZATION OF DIESEL PRECOMBUSTION CHAMBER DESIGN REGARDING FUEL ECONOMY AND EXHAUST EMISSIONS WITH ADDITIONAL ATTENTION TO NITRIC OXIDE FORMATION Ph.D. Thesis
Rodoljub Stevan Radovanovic 1978 179 p
Avail: Univ. Microfilms Order No. 7819207

A one cylinder Lister SR1, four-stroke, air-cooled engine with direct injection was redesigned and reworked into an indirect injection engine--precombustion chamber type. Basic design features and limitation of the test head and of the precombustion chamber in particular are presented and discussed. By systematic experimentation, through twenty-three different test runs, with three different throttling nozzles and two compression ratios, seventeen different perchambers were tested: the results are presented and discussed. A correlation of prechamber design parameters and engine operating characteristics is made with engine performance and pollutants. Dissert. Abstr.

N79-11402* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
POSITIVE ISOLATION DISCONNECT Patent
Morley V. Friedell, inventor(to NASA) (Martin Marietta Corp., Denver, Colo.) Issued 1 Aug. 1978 8 p Filed 15 Dec. 1976 Supersedes N77-15397 (15 - 06, p 0756) Sponsored by NASA
(NASA-Case-MSC-16043-1; US-Patent-4,103,712; US-Patent-Appl-SN-750792; US-Patent-Class-137-637.05; US-Patent-Class-137-614.06; US-Patent-Class-251-149.9; US-Patent-Class-285-326; US-Patent-Class-285-359) Avail: US Patent Office CSCL 13K

A disconnect composed basically of two halves each consisting of a poppet valve operable to isolate fluid with essentially zero fluid loss is presented. The two halves are coupled together by a quickly releasable coupling which may be either a coupling ring tightened or loosened by a twisting motion, or a clamp operated by a pivoted to prevent disconnecting the two halves until both valves are in closed condition. The positive feature of the device is one requiring a valve closing step before a disconnect step, and takes structural form in an ecdentric lobe mounted on the valve operating stem. If some obstruction prevents the poppet from moving to its seat, the eccentric lobe cannot be rotated to the closed position, and the interlock prevents a disconnect. Official Gazette of the U.S. Patent Office

N79-11403* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FUEL DELIVERY SYSTEM INCLUDING HEAT EXCHANGER MEANS Patent
George A. Coffinberry, inventor (to NASA) (G.E., Cincinnati, Ohio) Issued 8 Aug. 1978 6 p Filed 29 Nov. 1976 Sponsored by NASA
(NASA-Case-LEW-12793-1; US-Patent-4,104,873; US-Patent-Appl-SN-745766; US-Patent-Class-60-39.28R; US-Patent-Class-60.39.08; US-Patent-Class-60-39.66) Avail: US Patent Office CSCL 13I

A fuel delivery system is presented wherein first and second heat exchanger means are each adapted to provide the transfer of heat between the fuel and a second fluid such as lubricating oil associated with the gas turbine engine. Valve means are included which are operative in a first mode to provide for flow of the second fluid through both first and second heat exchange means and further operative in a second mode for bypassing the second fluid around the second heat exchanger means.
Official Gazette of the U.S. Patent Office

N79-11404* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SPHERICAL BEARING Patent
William N. Myers and Leopold A. Hein, inventors (to NASA) Issued 8 Aug. 1978 8 p Filed 29 Oct. 1976 Supersedes N77-11403 (15 - 02, p 0200)
(NASA-Case-MFS-23447-1; US-Patent-4,105,261; US-Patent-Appl-SN-736909; US-Patent-Class-308-72; US-Patent-Class-308-194) Avail: US Patent Office CSCL 13I

A spherical bearing including an inner ball with an opening for receiving a shaft and a spherical outer surface is described. Features of the bearing include: (1) a circular outer race including a plurality of circumferentially spaced sections extending around the inner ball for snugly receiving the inner ball; and (2) a groove extending circumferentially around the race producing a thin wall portion which permits the opposed side portions to flex relative to the ball for maximizing the physical contact between the inner surface of the race and the spherical outer surface of the ball. Official Gazette of the U.S. Patent Office

N79-11405* National Aeronautics and Space Administration. Pasadena Office, Calif.
PLASMA IGNITER FOR INTERNAL COMBUSTION ENGINE Patent
Dennis J. Fitzgerald and Robert R. Breshears, inventors (to NASA) Issued 31 Oct. 1978 7 p Filed 1 Apr. 1976 Supersedes N78-13440 (16-04, p 0482) Sponsored by NASA
(NASA-Case-NPO-13828-1; US-Patent-4,122,816; US-Patent-Appl-SN-672636; US-Patent-Class-123-148DC; US-Patent-Class-123-148E; US-Patent-Class-315-209CD; US-Patent-Class-315-209SC; US-Patent-Class-315-241R) Avail: US Patent Office CSCL 21A

An igniter for the air/fuel mixture used in the cylinders of an internal combustion engine is described. A conventional spark is used to initiate the discharge of a large amount of energy stored in a capacitor. A high current discharge of the energy in the capacitor switched on by a spark discharge produces a plasma and a magnetic field. The resultant combined electromagnetic current and magnetic field force accelerates the plasma deep into the combustion chamber thereby providing an improved ignition of the air/fuel mixture in the chamber.
Official Gazette of the U.S. Patent Office

N79-11406*# Ford Motor Co., Dearborn, Mich.
AUTOMOTIVE STIRLING ENGINE DEVELOPMENT PRO-

GRAM Quarterly Technical Progress Report, Apr. 1978 - Jun 1978
Jun. 1978 96 p Sponsored by NASA
(Contract EC-77-C-02-4396)
(NASA-CR-159436; CONS/4396-3) Avail: NTIS HC A05/MF A01 CSCL 13F

The third quarter (April-June, 1978) effort of the Ford/DOE Automotive Stirling Engine Development Program is reported, specifically Task 1 of that effort, which is Fuel Economy Assessment. At the end of this quarter the total fourth generation fuel economy projection was 26.12 MPG (gasoline) with a confidence level of 44%. This represents an improvement of 66.4% over the baseline M-H fuel economy of 15.7 MPG. The confidence level for the original 20.6 MPG goal has been increased from 53% to 57%. Engine 3X17 has accumulated a total of 213 hours of variable speed running. A summary of the individual sub-tasks of Task 1 are given. The sub-tasks are grouped into two categories: Category 1 consists of those sub-tasks which are directly related to fuel economy and Category 2 consists of those sub-tasks which are not directly related to fuel economy but are an integral part of the Task 1 effort. G.Y.

N79-11407*# AiResearch Mfg. Co., Phoenix, Ariz.
MINI-BRU/BIPS FOIL BEARING DEVELOPMENT Progress Report, 1 Jan. 1978 - 30 Jan. 1978
F. X. Dobler and L. J. Miller Oct. 1978 150 p refs
(Contract NAS3-18517)
(NASA-CR-159442; AiResearch-31-2936) Avail: NTIS HC A07/MF A01 CSCL 13E

The analysis revealed the failure agent to be a combination of poor teflon coating adhesion, a decrease in bearing sway space and, possibly, lack of flushing flow through the bearing. A change in Teflon coating vendors provided substantially improved coating quality and surface finish. The sway space was increased and the cooling bleed flow was adjusted to flush the bearing. These changes were included in a test conducted in the WHL from 6 April to 22 May 1978 which resulted in the completion of 1006.9 hours of operation at temperature and load. Post-test inspection revealed the bearings to be in excellent condition and capable of completing a much longer test. L.S.

N79-11408*# AiResearch Mfg. Co., Phoenix, Ariz.
ANALYSIS, DESIGN, FABRICATION AND TESTING OF THE MINI-BRAYTON ROTATING UNIT (MINI-BRU). VOLUME 1: TEXT AND TABLES Final Report, Apr. 1974 - Jun. 1978
F. X. Dobler et al Oct. 1978 219 p refs 2 Vol.
(Contract NAS3-18517)
(NASA-CR-159441-Vol-1; AiResearch-31-2935-1) Avail: NTIS HC A10/MF A01 CSCL 13I

A 500 to 2100 watt power output Mini-Brayton Rotating Unit (Mini-BRU)was analyzed, designed, fabricated and tested. Performance and test data for the various components is included. Components tested include the 2.12 in. diameter compressor, the 2.86 in. diameter turbine, the Rice alternator and the cantilevered foil-type journal and thrust bearings. Also included are results on the fabrication of a C-103 turbine plenum/nozzle assembly and on offgassing of the organic materials in the alternator stator. Author

N79-11409*# AiResearch Mfg. Co., Phoenix, Ariz.
ANALYSIS, DESIGN, FABRICATION AND TESTING OF THE MINI-BRAYTON ROTATING UNIT (MINI-BRU). VOLUME 2: FIGURES AND DRAWINGS Final Report
F. X. Dobler Oct. 1978 448 p 2 Vol.
(Contract NAS3-18517)
(NASA-CR-159441-Vol-2; AiResearch-31-2935-2) Avail: NTIS HC A19/MF A01 CSCL 13I

This volume contains the figures and drawings reference in Volume 1. Author

N79-11410# Parks College of St. Louis Univ., Cahokia.
HELICOPTER BEARING FAILURE DETECTION UTILIZING SHOCK PULSE TECHNIQUES Final Report
John A. George, Timothy C. Mayer, Harold W. Sutphin, and J. Thomas Harrington 20 Sep. 1977 480 p
(Contract DAAJ01-72-A-0027)
(AD-A057308; USAAVRADCOM-TR-78-6) Avail: NTIS HC A21/MF A01 CSCL 01/3

The Shock Pulse technique works on the principle that a discrete fault, such as a pit or a spall, will cause repetitive impacts of short duration. These impacts will cause shock waves to propagate through the bearing structure causing a pulse displacement input to an accelerometer, suitably, attached to the bearing structure. The output of the accelerometer passes through a high gain amplifier tuned at the resonant frequency of the accelerometer (this amplifier then acts as a sharp band-pose filter). After the signal is processed the output is displayed on a counter which provides the frequency of peaks above any desired peak amplitudes. GRA

N79-11411# Battelle Columbus Labs., Ohio.
EVALUATION OF THE FEASIBILITY OF JOINING TITANIUM ALLOY TO HEAVYMET TUNGSTEN ALLOY Final Report
V. D. Linse and H. E. Pattee 7 Jun. 1978 19 p
(Contract W-7405-eng-48)
(UCRL-13857; SANL-507-019) Avail: NTIS HC A02/MF A01

A program to select and evaluate methods of brazing and/or explosively welding Ti-6Al-4V titanium alloy to Heavymet, a tungsten-base metal containing up to about 20 percent alloying elements (nickel, copper, etc.) to improve its ductility and other mechanical properties, is described. Designs permitting the reliable production of joints between these base metals were also investigated. The investigation was primarily an engineering study of the problems associated with joining these base metals in the required configurations. Limited experimental studies were also conducted. The joining methods are reviewed individually. Recommendations for developing a viable titanium-tungsten joining procedure are discussed. DOE

N79-11412# California Univ., Livermore. Lawrence Livermore Lab.
COMPUTER MODELING OF AUTOMOTIVE ENGINE COMBUSTION
C. K. Westbrook and L. C. Haselman Dec. 1977 26 p refs Presented at Natl. Computing Conf., Anaheim, Calif., 5-8 Jun. 1978
(Contract W-7405-eng-48)
(UCRL-80451; Conf-780615-2) Avail: NTIS HC A03/MF A01

A general outline of the physical and chemical events which occur in an automobile combustion chamber during a complete engine cycle is used in discussing some of the achievements and some of the limitations of computer modeling of automotive engine combustion. This type of modeling is often limited by lack of physical knowledge and by computer software and hardware restrictions. Still, within these constraints, many types of combustion models were able to make important contributions to present understanding of automobile engine combustion. DOE

N79-11413# Bettis Atomic Power Lab., West Mifflin, Pa.
ARC MODELING FOR WELDING ANALYSIS
S. S. Glickstein Apr. 1978 65 p refs
(Contract EY-76-C-11-0014)
(WAPD-TM-1382) Avail: NTIS HC A04/MF A01

A one-dimensional model of the welding arc that considers heat generation by the Joule effect and heat losses by radiation and conduction was used to study the effects of various gases and gas mixtures currently employed for welding applications. Minor additions of low ionization potential impurities to these gases significantly perturb the electrical properties of the parent gas causing gross changes in the radial temperature distribution of the arc discharge. Such changes are reflected in the current density distribution and ultimately in the input energy distribution to the weldment. The result is observed as a variation in weld penetration. Published experiments and analyses of welding arcs are also evaluated and shown to contain erroneous data and results. The one-dimensional analysis of the welding arc as well as the evaluation of published reports helps to explain the effects of various gases used for welding and improves understanding of the physics of the welding arc. DOE

N79-11414# Argonne National Lab., Ill.
PRELIMINARY EVALUATION OF SEVERAL NONDESTRUCTIVE-EVALUATION TECHNIQUES FOR SILICON NITRIDE

GAS-TURBINE ROTORS
D. S. Kupperman, C. Sciammarella, N. P. Lapinski, A. Sather, D. Yuhas, L. Kessler, and N. F. Fiore Jan. 1978 80 p refs
(Contract W-31-109-eng-38)
(ANL-77-89) Avail: NTIS HC A05/MF A01

Several nondestructive-evaluation (NDE) techniques were examined. Preliminary results were obtained for holographic interferometry, acoustic microscopy, dye-enhanced radiography, acoustic emission, and acoustic-impact testing techniques. The relative effectiveness of these techniques in terms of their applicability to the rotor geometry and ability to detect critically sized flaws is discussed. Where feasible, flaw indications were verified by alternative NDE techniques or destructive examination. This study indicates that, since the various techniques have different advantages, ultimately a reliable interrogation of ceramic rotors may require the application of several NDE methods. DOE

N79-11415# California Univ., Livermore. Lawrence Livermore Lab.
HORIZONTAL GAS-TUNGSTEN-ARC WELDING OF 0.020-IN. (0.5-MM) 1100 ALUMINUM
R. H. Carpenter 17 Mar. 1978 14 p
(Contract W-7405-ENG-48)
(UCID-17780) Avail: NTIS HC A02/MF A01

The procedure developed for butt welding 0.020 in. (0.5 mm) 1100 aluminum horizontally by means of the gas-tungsten-arc process is described. The depth of penetration was 100%, and sectioning showed the nugget to be free of porosity and other defects. DOE

N79-11416# National Technical Information Service, Springfield, Va.
MOTOR VEHICLE TIRES: SKID AND WEAR RESISTANCE. NONDESTRUCTIVE TESTS: SAFETY. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jul. 1978
Guy E. Habercom, Jr. Sep. 1978 101 p Supersedes NTIS/PS-77/0810; NTIS/PS-76/0643
(NTIS/PS-78/0923/9; NTIS/PS-77/0810; NTIS/PS-76/0643) Avail: NTIS HC $28.00/MF $28.00 CSCL 13F

Skid resistance and wear qualities of vehicle tires are investigated from a worldwide literature survey. Nondestructive test methods are evaluated. This updated bibliography contains 95 abstracts, 17 of which are new entries to the previous edition. GRA

N79-11417# National Technical Information Service, Springfield, Va.
MOTOR VEHICLE TIRES: SKID AND WEAR RESISTANCE. NONDESTRUCTIVE TESTS: SAFETY. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jul. 1978
Guy E. Habercom, Jr. Sep. 1978 203 p Supersedes NTIS/PS-77/0809; NTIS/PS-76/0642; NTIS/PS-75/533; COM-74-11372
(NTIS/PS-78/0922; NTIS/PS-77/0809; NTIS/PS-76/0642; NTIS/PS-75/533; COM-74-11372) Avail: NTIS HC $28.00/MF $28.00 CSCL 13F

Skid resistance and wear qualities of vehicle tires are investigated. Nondestructive test methods are evaluated, as well as the extent of compliance with Federal Safety Standards of foreign and domestic tires. This updated bibliography contains 197 abstracts, 22 of which are new entries to the previous edition. GRA

N79-11418# National Technical Information Service, Springfield, Va.
AUTOMOBILE IMPACT TESTS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1973 - Aug. 1978
Edith Kenton Aug. 1978 163 p Supersedes NTIS/PS-77/0734; NTIS/PS-76/0694; NTIS/PS-75/651
(NTIS/PS-78/0892/6; NTIS/PS-77/0734; NTIS/PS-76/0694; NTIS/PS-75/651) Avail: NTIS HC $28.00/MF $28.00 CSCL 13F

This bibliography covers impact tests for car design, for studying passenger safety, and for design and safety of highway structures and barriers. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N79-11419 Cornell Univ., Ithaca, N. Y.
EXTREME VALUE THEORY IN TRIANGULAR ARRAYS WITH AN APPLICATION TO THE RELIABILITY OF FIBROUS MATERIALS Ph.D. Thesis
Wagner de Souza Borges 1978 90 p
Avail: Univ. Microfilms Order No. 7817851

The necessity of determining the limit behavior of row extremes in triangular arrays, whose elements are sums of independent random variables, arises in may practical situations. This problem is considered and results are developed which make use of the Theory of Large Deviations and a convergence criterion due to Loeve. An important application is made to the problem of studying the limit behavior of the reliability of composite materials consisting of a low stiffness matrix, reinforced with high strength and high stiffness fibers aligned in parallel. These composites are modeled and the reliability is measured by the probability distribution of the time to failure of the structure. A limit result is developed for these composites, under constant load. Other potential uses of the method are indicated and related problems for further research are discussed. Dissert. Abstr.

N79-11420 Drexel Univ., Philadelphia, Pa.
AN ULTRASONIC NONDESTRUCTIVE TEST PROCEDURE FOR THE EARLY DETECTION OF FATIGUE DAMAGE AND THE PREDICTION OF REMAINING LIFE Ph.D. Thesis
James Matthew Carson 1978 94 p
Avail: Univ. Microfilms Order No. 78179991

The most dangerous flaw is one that is crack-like or that serves as a crack initiation site. A procedure to detect and estimate fatigue damage occurring at such a site is reported. A computer based data acquisition system is used to analyze data from 2024-T4 A1 fatigue specimens containing a through hole. Specimens are fatigue loaded to produce a spectrum of damage levels and interrogated using a simple contact 10 MHz shear wave system. Features selected from the signal amplitude time, spectrum, and cepstrum signatures are used in a computer learning network to make a early detection of fatigue damage and quantitative prediction of remaining life. A scanning microscope is used to examine the damage of the limit of detection. Fatigue damage was sensed with 92 percent success after 10 percent of specimen life. Estimates of damage were made within + or -20 of the actual fatigue life percentage for 76 percent of the data. Dissert. Abstr.

N79-11421# Modern Analysis, Inc., Ridgewood, N. J.
RELIABILITY-BASED SCATTER FACTORS. VOLUME 2: COMPUTER MANUAL Final Report, Mar. 1977 - Mar. 1978
Masanobu Shinozuka Mar. 1978 36 p
(Contract F33615-77-C-3055)
(AD-A056637; AFFDL-TR-78-17-Vol-2) Avail: NTIS HC A03/MF A01 CSCL 01/3

A definition of scatter factor is introduced that is rational and at the same time can directly be related to the reality of aircraft design and certification as well as of the full-scale and also coupon fatigue test of structural elements or components. Specifically, the scatter factor is defined as the ratio of the MLE (maximum likelihood estimate) of the scale parameter of the two-parameter Weibull distribution assumedly describing the life distribution of structural elements or components, to the 'time to first failure' among a fleet of nominally identical elements or components subjected also to nominally identical operating conditions. GRA

N79-11422# Naval Postgraduate School, Monterey, Calif.
NONPARAMETRIC ESTIMATION FROM CENSORED DATA Ph.D. Thesis
Lee Won Hyung Mar. 1978 76 p refs
(AD-A056332) Avail: NTIS HC A05/MF A01 CSCL 14/4

For nearly two decades there has been an intensive development of a statistical methodology for assessing length

of life and reliability of performance from empirical data. The initial stimulus for research on statistical problems in life testing and reliability came from the need to answer pressing practical questions which could not be treated by the existing statistical techniques. Because life and performance tests are so time consuming and expensive to run, it is a practical necessity to terminate them as soon as possible. For the statistician this means developing estimation and developing estimation and decision procedure for data, which are severely curtailed in one way or another long before all items on test have actually failed. The estimation is more complicated when the data are truncated, i.e., when the observer loses track of some individuals before death occurs. The product limit method Kaplan and Meier is one way of estimating p(t) when the mechanism causing truncation is independent of the mechanism causing death. This paper proposes alternative estimators and compares them to the product limit method. A computer simulation is used to generate the times of death and truncation from a variety of assumed distributions. No single estimator gives the best fit to the 'true' distribution of death under all situations. However, other estimators are shown to be better than the product limit estimator under all of the assumed situations. GRA

N79-11423# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
AN AQL-AOQL PROCESS CONTROL SYSTEM FOR FRACTION DEFECTIVE
Richard S. Leavenworth, Richard L. Scheaffer, Zoran Lekic, and Henri Lorberbaum Jun. 1978 79 p
(Contract N00014-75-C-0783)
(AD-A057349; RR-78-8) Avail: NTIS HC A05/MF A01 CSCL 13/8

This research reports on an acceptance control chart system based on a combination of AQL AOQL. It is designed to augment and parallel ISE TR 76-4 'Procedure for Maintenance and Rework Process Quality Control Based on Random Sampling' in Those situations in which large numbers of essentially identical items are produced. Author (GRA)

N79-11424# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.
A SCREENING TEST METHOD EMPLOYING A THERMAL VACUUM FOR THE SELECTION OF MATERIALS TO BE USED IN THE MANUFACTURE OF SPACECRAFT OPTICAL DEVICES
Paris ESA Jan. 1978 13 p
(ESA-PSS-43/QRM-31T-Issue-1) Avail: NTIS HC A02/MF A01

An accelerated means of determining the outgassing of materials proposed for use in the manufacture of spacecraft optical devices is given. The test uses two cycles of the micro VCM test method as defined in the specification ESA PSS-09/QRM-02T Issue 2 (August 1976). The first cycle is intended to simulate the post curing of materials used in the manufacture of the device, and for the second cycle is intended to reveal the material's actual behavior in the thermal environment of space. Outgassing data of some materials tested in accordance with the procedure are listed. Author (ESA)

N79-11425# European Space Research and Technology Center, Noordwijk (Netherlands). Product Assurance Div.
GUIDELINES FOR THE SELECTION, EVALUATION, SCREENING AND LOT ACCEPTANCE OF NON-STANDARD ELECTRONIC, ELECTRICAL AND ELECTROMECHANICAL PARTS
Paris ESA Apr. 1978 29 p
(ESA-Spec-QRC-50G-Issue-1) Avail: NTIS HC A03/MF A01

Rules for selection, evaluation, screening and lot acceptance of non-standard electronic, electrical, and electromechanical parts for space application are presented. These procedures ensure a cost effective and timely project qualification. They are based on a technology oriented approach with built-in 'check points'. These check points ensure that the various phases are only entered with the maximum chance of success or alternatively allow an unsatisfactory program to be terminated with minimum cost and schedule penalties. Author (ESA)

N79-11426# Aeritalia S.p.A., Torino (Italy).
EVALUATION OF CRACK DETECTION METHODS, PHASE 2 Final Report
G. Magistrali (FIAT) and F. Sevino Paris ESA Feb. 1978 107 p refs
(Contract ESTEC-2542/75-PP(SC))
(ESA-CR(P)-1092) Avail: NTIS HC A06/MF A01

Nondestructive testing reliability with specific regard to the Spacelab project was investigated experimentally. The general outline of a program for assessing the reliability of a nondestructive inspection method is discussed. A detailed description of the experimental layout is explained with all technical parameters involved. Radiographic and ultrasonic methods were investigated in relation to their detection sensitivity for a defect like incomplete penetration in a butt welding in aluminum alloy plates. The reliability evaluation of the nondestructive testing technique was carried out in terms of flaw detection capability graphs, obtained on a statistical basis by employing several inspectors. The results reported can be applied to structural design for fracture mechanics purposes as they cover crack-like defects, exhibiting a high stress concentration factor. An investigation on dye liquid penetrants was carried out for specific interest in the Spacelab project. Author (ESA)

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N79-11427 Cornell Univ., Ithaca, N. Y.
MAGNETICALLY INDUCED CYLINDRICAL STRESS WAVES IN A THERMOELASTIC CONDUCTOR Ph.D. Thesis
Chian Thang Chian 1978 238 p
Avail: Univ. Microfilms Order No. 7817853

The problem of stress wave generation in a linear thermoelastic solid by a pulsed magnetic field is investigated both analytically and experimentally for a cylindrically symmetric conducting solid. The analytical model predicts a body force generated stress wave, a thermoelastic wave, and a quasi-static thermoelastic stress field. In the experiment, a transient magnetic field was applied normally in the circular cavity of a large conducting plate. The field was generated by discharging a large capacitor bank through a solenoidal coil. Resulting plane-stress cylindrical stress waves are one-dimensional in nature. The current pulse has a finite rise time and the Joule heating produced by eddy currents is confined in some finite boundary layer adjacent to the circular cavity. Since the thermal diffusion time is greater than the stress wave travel time, the temperature remains steady within the layer, while the stress wave propagates outward from the layer. A dynamic response analysis method is developed to correlate magnetic, thermal, and stress fields in the solid with the time history of the electric currents. Dissert. Abstr.

N79-11428 Florida Univ., Gainesville.
INELASTIC STATIC AND DYNAMIC ANALYSIS OF PLANE FRAMES INCLUDING GEOMETRIC NONLINEARITIES Ph.D. Thesis
Tholappa Santhanam 1978 482 p
Avail: Univ. Microfilms Order No. 7817456

A program, FRAME 63, is developed. Constitutive models are handled at the stress-strain level. The proposed model for mold steel is characterized by stiffness degradation factor alpha, and a yield stress growth factor Beta. The model is fitted to available experimental results in uniaxial reversed loadings, and the factors alpha, Beta are estimated. In turn, these are used in the anlaysis of frames. A modified procedure of the traditional tangent stiffness method is adopted to minimize convergence difficulties due to material and soil support inelasticity. Three static experimental results and three analytical dynamic results of frames are analyzed and discussed. A complete input guide, with examples, is presented. Guidelines are given for efficient use of the offline storage units needed in the program. Dissert. Abstr.

N79-11429 Cornell Univ., Ithaca, N. Y.
STRESS ANALYSIS FOR A UNIDIRECTIONAL COMPOSITE REINFORCED WITH A DOUBLY PERIODIC ARRAY OF IDENTICAL INCLUSIONS Ph.D. Thesis
Li-chung Lee 1978 138 p
Avail: Univ. Microfilms Order No. 7817865

The idealized composite is characterized by an infinitely large two-dimensional body (the matrix) reinforced with a doubly periodic array of identical inclusions (the fibers). The body is in tension or compression. The two-dimensional, plane stress analysis is based upon a complex variable formulation in conjunction with the boundary point matching method or the boundary point least squares method. Investigation of a repeating element is performed throughout the analysis. In the problems, perfect bonding between fibers and matrix is assumed, and as a result stress and displacement are taken as continuous across the interfaces. Three different problems are investigated; an isotropic body reinforced with doubly periodic array of circular inclusions; an isotropic body with arbitrarily shaped rigid inclusions; and an orthotropic body with circular rigid inclusions. Dissert. Abstr.

N79-11430 Drexel Univ., Philadelphia, Pa.
STATISTICAL APPROACH TO SCALE EFFECT AND RESIDUAL STRENGTH IN COMPOSITE MATERIAL FATIGUE Ph.D. Thesis
Robert Bruce Croman 1978 107 p
Avail: Univ. Microfilms Order No. 7817900

Statistical techniques are used to study the scale effect and residual strength of graphite/epoxy composites subjected to fatigue loading. A method is presented to predict the strength or fatigue life of a structure that can be considered as composed of a number of basic elements arranged in-series, if the strength or life distribution of the basic element is known. Methods of predicting the residual strength of a specimen are given that are based on the specimen static strength and fatigue life distribution. The scale effect study was experimentally checked for basic elements and in-series structures of graphite/epoxy composites subjected to compression loading conditions. The residual strength studies were compared with six sets of graphite/epoxy tension residual strength data obtained from four independent researchers. Dissert. Abstr.

N79-11431 Rochester Univ., N. Y.
DYNAMIC FRACTURE TESTING USING SHEAR FORCE MEASUREMENTS ON DOUBLE CANTILEVER BEAM SPECIMENS Ph.D. Thesis
Chang-Lun Chow 1978 179 p
Avail: Univ. Microfilms Order No. 7818251

Investigating the dynamic critical stress intensity factor versus the crack propagation velocity of Ti-6Al-4V alloy and AISI 1018 cold rolled steel is the main purpose of this work. A new experimental technique was introduced for achieving the dynamic fracture testing. This technique employs a strain gage rosette to measure the time-dependent shear force at the constant displacement-rate opening end of a DCB specimen. The product of the shear force and the square root of the loading time is a slowly varying time function and is uniquely related to the critical bending moment at the crack tip during crack propagation. The critical bending moment is the propagation fracture criterion for a rapidly wedged DCB specimen in the limit of Bernoulli-Euler beam theory. The magnitude of the critical bending moment is calculated from an available fully dynamic analysis of crack propagation. Dissert. Abstr.

N79-11432 Rochester Univ., N. Y.
IMPRESSION CREEP: A NEW CREEP TEST Ph.D. Thesis
Sung-nee George Chu 1978 202 p
Avail: Univ. Microfilms Order No. 7818252

Impression creep as a new creep test is established in this study. Both large grain succinonitrile polycrystals and B-Tin single crystals were tested. Parallel processes were studied in detail by this new method in the creep of B-Tin single crystals in three orientations. The two possible processes were determined as high temperature dislocation climb and low temperature dislocation slip processes. Complete pencil slip was observed for the first time. This was in B-Tin single crystal. Impression recovery as a new recovery test was studied in commercial polymethylmethacrylate (Plexiglass). The data were analyzed using second order kinetics near equilibrium. Dissert. Abstr.

N79-11433*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL-STRUCTURAL MISSION ANALYSES OF AIR-COOLED GAS TURBINE BLADES
Albert Kaufman and Raymond E. Gaugler 1978 13 p refs
Proposed for presentation at the Intern. Gas Turbine Conf., San Diego, Calif., 11-15 Mar. 1979
(NASA-TM-78963; E-9720) Avail: NTIS HC A02/MF A01 CSCL 21E

Cyclic temperature and stress-strain states in cooled turbine blades were calculated for a simulated mission of an advanced technology aircraft engine. TACT1 (three dimensional heat transfer) and MARC (nonlinear structural analysis) computer programs were used to analyze impingement cooled airfoils, with and without leading-edge film cooling. Creep was the predominant damage mode, particularly around film cooling holes. Radially angled holes exhibited less creep than holes normal to surface. Beam-type analyses of all-impingement cooled airfoils gave fair agreement with MARC results for initial creep. Author

N79-11434# Naval Research Lab., Washington, D. C. Metals Performance Branch.
EFFECT OF SPECIMEN DIMENSIONS OF K SUB Iscc DETERMINATION BY THE CANTILEVER METHOD Final Report
C. T. Fujii 31 May 1978 14 p refs
(NRL Proj. MO-09; RR0220844)
(AD-A056064; NRL-8236) Avail: NTIS HC A02/MF A01 CSCL 11/6

There is a critical need for standardization of K sub Iscc test procedures to assure the documentation of only valid data. An important area of concern is the development of realistic specimen requirements which are applicable to K sub Iscc tests rather than adopting those used in K sub IC determinations. The present studies were aimed at systematically evaluating the effects of specimen thickness, ligament length, and initial crack length on the threshold for stress-corrosion crack growth K sub Iscc by the cantilever method. GRA

N79-11435# Clarkson Coll. of Technology, Potsdam, N.Y. Dept. of Mechanical and Industrial Engineering.
OPTIMUM DESIGN OF FRAMES USING LINEAR PROGRAMMING TECHNIQUES Technical Report, Oct. 1977 - Jun. 1978
Walter J. Briggs and Kenneth D. Willmert Jun. 1978 41 p refs
(Contract N00014-76-C-0064)
(AD-A056607; MIE-026) Avail: NTIS HC A03/MF A01 CSCL 13/13

Presented is an optimization technique, using linear programming methods, which can effectively be used to design structural frames. Stress constraints as well as conditions of equilibrium and compatibility are considered. The approach is demonstrated to be more efficient than presently available nonlinear techniques on large problems. Although the method is iterative, a modification of the standard simplex method is used which considerably decreases computational time. A discussion is presented outlining how the technique can be extended to handle additional requirements such as multiple loading conditions, non-nodal loads and displacement constraints. Author (GRA)

N79-11436# Virginia Univ., Charlottesville. Dept. of Materials Science.
INVESTIGATION OF ELONGATION AND ITS RELATIONSHIP TO RESIDUAL STRESSES IN BORON FILAMENTS
Franklin E. Wawner, Jr. Jun. 1978 52 p refs
(Contract N00014-76-C-0694)
(AD-A056528; UVA/525322/MS78/101; TR-1) Avail: NTIS HC A04/MF A01 CSCL 11/5

Measurements have been made to determine elongation on boron filaments while they are being produced by chemical vapor deposition. To date the primary variable that appears to influence the elongation is deposition temperature which verifies earlier results. Small amounts of additives of silicon and tungsten have

been incorporated into the filaments via the gas phase to determine if this approach would minimize the elongation. No positive results were obtained. Structural and microstructural studies on the filaments using transmission electron microscopy and diffraction have shown an apparent difference in boron at the surface and that near the core. The surface material appears to grow in a column type structure approximately 1000 A in diameter. No evidence of microcrystals of one of the crystalline polymorphs has been obtained. The filaments were observed to contract by almost 2% after 10 minutes at 900 C. Examination of the cross section of these filaments show extensive void formation in the region adjacent to the core. The experiments suggest that boron is being removed by a surface reaction. GRA

N79-11437# United Technologies Research Center, East Hartford, Conn.
REDESIGN OF STRUCTURAL VIBRATION MODES BY FINITE ELEMENT INVERSE PERTURBATION Final Technical Report, 12 Jul. 1977 - 12 Feb. 1978
K. A. Stetson, I. R. Harrison, and B. N. Cassenti May 1978 70 p refs
(Contract F33615-77-C-2092)
(AD-A057662; UTRC/R77-992945; AFAPL-TR-78-21) Avail: NTIS HC A04/MF A01 CSCL 13/13

It has been demonstrated that it is feasible to apply the inverse perturbation method, originally developed at United Technologies Research Center, directly to the output of a finite element computer analysis of a structure. Thus, a new structural design tool has been developed which has the potential for application to the mathematically complex structure of a turbine blade. The initial step in this direction, as described herein, was the redesign of a flat plate and a 45 degree arc of a cylindrical shell, both mounted as cantilever beams. Included in the report, in addition to a detailed review of the contract work, is an overview of the concept of inverse perturbation, and a detailed description of previous UTRC work on redesigning structural vibration modes by inverse perturbation subject to minimal change theory, which set the stage for the present investigations. GRA

N79-11438# Army Construction Engineering Research Lab., Champaign, Ill.
DYNAMIC RESPONSE OF REINFORCED CONCRETE STRUCTURES
Sushil K. Sharma Jul. 1978 30 p refs
(DA Proj. 4A1-61102-AT-23)
(AD-A056627; CERL-SR-M-243) Avail: NTIS HC A03/MF A01 CSCL 13/13

Beam-column and plane stress finite elements were described for an inelastic analysis of plane RC structures under earthquake-type ground motion. Material nonlinearities in the beam-column finite element were taken into account by considering cyclic inelastic deformations throughout the element. The plane stress finite element allowed for cracking of the element in tension. These elements were incorporated in the DRAIN-2D computer program, which was determined to be flexible and efficient. Preliminary results for simple structures showed that, with the addition of new finite elements described in this report, this program would be very useful for practical investigations of RC structures. Author (GRA)

N79-11439# RAND Corp., Santa Monica, Calif.
PROBABILITY THAT THE PROPAGATION OF AN UNDETECTED FATIGUE CRACK WILL NOT CAUSE A STRUCTURAL FAILURE Interim Report
J. R. Gebman and P. C. Paris Jun. 1978 80 p refs
(AD-A057335; RAND/R-2238-RC) Avail: NTIS HC A05/MF A01 CSCL 01/3

The undetected propagation of a fatigue crack constitutes a significant cause of aircraft and other structural failures. To raise the structural failure load to a relatively high level, the manufacturer can divide the structure into many small elements, which significantly increases the ability of a structure to tolerate an element failure. This report presents a procedure for calculating the probability that the element has not failed, as a function of the crack propagation time and hence, the crack's length. The procedure's form is so simple that computations with a desk calculator can yield reasonably accurate results. To illustrate this, the report uses data that an aircraft manufacturer developed for the structural components/elements that currently limit the service life of an existing transport aircraft. Author (GRA)

N79-11440# Naval Postgraduate School, Monterey, Calif.
LATERAL BUCKLING OF BEAMS WITHOUT WARPING RIGIDITY M.S. Thesis
Robert Edward Brown Jun. 1978 57 p refs
(AD-A057340) Avail: NTIS HC A04/MF A01 CSCL 13/13

A procedure is described to determine lateral buckling loads for initially straight beams. Loading and beam geometry may vary along the length. Warping rigidity is not considered. End conditions of considerable generality may be treated. The algorithm depends on solving a convergent sequence of six-teenth order eigenproblems. A computer program implementing this procedure has been developed and is described herein. Author (GRA)

N79-11441# Naval Civil Engineering Lab., Port Hueneme, Calif.
A VISCOELASTIC-PLASTIC CONSTITUTIVE MODEL WITH A FINITE ELEMENT SOLUTION METHODOLOGY Final Report, Aug. 1974 - Aug. 1977
M. Katona Jun. 1978 162 p refs
(ZR00001141)
(AD-A057684; CEL-TR-866) Avail: NTIS HC A08/MF A01 CSCL 20/11

A textbook style development of viscoplasticity is presented. For completeness, the report also includes a detailed review of plasticity and viscoelasticity. The combination of plasticity and viscoelasticity is the basis for the so-called viscoelastic-plastic model developed herein. Other combo-viscoplastic models are also introduced. Each constitutive model is introduced with conceptual one-dimensional stress-strain models and then generalized for multidimensional stress space. Furthermore, each model is cast in an incremental form appropriate for numerical solution techniques. Finite element algorithms are outlined for incorporating these nonlinear constitutive models into boundary value problems. In particular, tangent stiffness and initial strain methods are discussed. The viscoelastic-plastic model is compared to experimental data for plexiglas and sea-ice to illustrate the versatility of the model in replicating nonlinear creep and flow of these materials. Moreover, the identification of the model parameters are shown to be no more difficult than the identification of parameters for the classical theories of plasticity and viscoelasticity. Author (GRA)

N79-11442# Hanford Engineering Development Lab., Richland, Wash.
EVALUATION OF THE ROUND COMPACT SPECIMEN FOR FATIGUE-CRACK GROWTH RATE TESTING
L. A. James and W. J. Mills Jun. 1978 29 p refs
(Contract EY-76-C-14-2170)
(HEDL-TME 78-56) Avail: NTIS (US Sales Only)
HC A03/MF A01; DOE Depository Libraries

A round compact specimen was evaluated and the results were compared to results from standard compact specimens. The two specimens were found to yield equivalent results. A number of K-solutions were proposed for the round compact specimen, and these are reviewed. The agreement between the various solutions was good, and the Newman Equation was used to evaluate the results. DOE

N79-11443# California Univ., Livermore. Lawrence Livermore Lab.
DUCTILE CRACK INITIATION IN THE CHARPY V-NOTCH TEST
W. L. Server (Fracture Control Corp., Goleta, Calif.), D. M. Norris, Jr., and M. E. Prado 25 Apr. 1978 18 p refs Presented at 107th AIME Meeting, Denver, Colo., 26 Feb. 1978
(Contract W-7405-eng-48)
(UCRL-81034; Conf-780213-9) Avail: NTIS HC A02/MF A01

Initiation and growth of a crack in the Charpy V-notch test was investigated by performing both static and impact controlled deflection tests. Test specimens were deformed to various deflections, heat-tinted to mark crack extension and broken apart at low temperature to allow extension measurements. Measurement of the crack extension provided an estimate of crack initiation as defined by different criteria. DOE

N79-11444# Bari Univ. (Italy). Ist. di Costruzione di Macchine.
ELASTIC STRESS CONCENTRATION OF A CRUCIFORM JOINT UPON BENDING [FATTORE DI INTAGLIO IN CAMPO ELASTICO PER GIUNTI A CROCE SOLLECITATI A FLESSIONE]
B. Atzori and G. Monno [1977] 15 p refs In ITALIAN; ENGLISH summary
Avail: NTIS HC A02/MF A01

The influence of the geometry on the elastic stress concentration factor K sub t of a cruciform welded joint in bending was investigated. Complete penetration was assumed for the analysis, which was performed using the finite element method, with isoparametric quadrangular elements in plane stress. The computations were carried out on an IBM 370-158.
Author (ESA)

N79-11445# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
SPECTRAL PROBLEMS IN VIBRATION MECHANICS
Jacqueline Boujot Mar. 1978 45 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-497)
(ONERA-P-1978-2) Avail: NTIS HC A03/MF A01

Vibration problems in linear theory are related to fundamental theory in functional and spectral analysis. Some results about spectral decomposition and spectral variational properties are recalled. A general theorem for linear oscillation is proven and some applications studied. It is shown that together with retrieving classical results, new problems may be solved such as coupled problems in vibration mechanics. An introduction to numerical analysis and computational techniques is given with application to system vibration modes. ESA

N79-11446# ASL Engineering, Goleta, Calif.
ENVIRONMENTALLY INDUCED CRACKING OF NATURAL GAS AND LIQUID PIPELINES. VOLUME 2: APPENDICES A AND B Final Report
J. A. Bartol, C. H. Wells, R. P. Wei et al Dec. 1977 150 p refs
(Contract DOT-OS-60519)
(PB-282924/0; DOT-MTB-OPSO-78-02) Avail: NTIS HC A07/MF A01 CSCL 13K

The Office of Pipeline Safety Operations was provided with an appraisal of the seriousness of certain types of environmentally induced cracking problems in natural gas and liquid petroleum pipelines. Measures for locating and identifying such cracks or for identifying conditions leading to their occurrence are identified. Predictions of future incidence probability are formulated and recommendations made for needed research and action. GRA

N79-11447# ASL Engineering, Goleta, Calif.
ENVIRONMENTALLY INDUCED CRACKING OF NATURAL GAS AND LIQUID PIPELINES. VOLUME 1: TECHNICAL REPORT Final Report
J. A. Bartol, C. H. Wells, and R. P. Wei Dec. 1977 146 p refs
(Contract DOT-OS-60519)
(PB-282923/2; DOT-MTB-OPSP-78-01) Avail: NTIS HC A07/MF A01 CSCL 13K

An appraisal of the seriousness of certain types of environmentally induced cracking problems in natural gas and liquid petroleum pipelines is provided for the Office of Pipeline Safety Operations. Measures for locating and identifying such cracks or for identifying conditions leading to their occurrence are identified. Predictions of future incidence probability are formulated and recommendations made for needed research and action. GRA

42 GEOSCIENCES (GENERAL)

No abstracts in this category.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.
For instrumentation see *35 Instrumentation and Photography*.

N79-11448 Pennsylvania State Univ., University Park.
MODELING STORM HYDROGRAPH WATER QUALITY: A PARTIAL AREA APPROACH Ph.D. Thesis
William John Gburek 1978 240 p
Avail: Univ. Microfilms Order No. 7818756

An interactive hydrology/water quality watershed model was developed to simulate the storm hydrograph and its associated electrical conductivity variations. With actual precipitation data as input, the model simulates the generation of the storm hydrograph using the partial contributing area approach to describe the dominant hydrologic processes. Separately simulated baseflow, modified direct interception, and surface runoff flow components are combined to form the storm hydrograph. Input required to apply the model is primarily spatially distributed watershed geometry and soils-related data. One partial calibration was required for each storm's analysis. Initial soil moisture levels were determined by calibrating the model to the measured volume of surface runoff produced by the storm. A limited analysis of the model's sensitivity to the water quality calibration parameters showed that the simulated electrical conductivity patterns are not dependent on the specific values chosen for the calibration parameters. Dissert. Abstr.

N79-11449*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
OPTIMUM THERMAL INFRARED BANDS FOR MAPPING GENERAL ROCK TYPE AND TEMPERATURE FROM SPACE Final Task Report, Jan. 1978 - Jul. 1978
Quentin A. Holmes and Daniel R. Nuesch Sep. 1978 45 p refs
(Contract NAS9-15362)
(NASA-CR-151842; ERIM-130100-13-F) Avail: NTIS HC A03/MF A01 CSCL 20F

A study was carried out to determine quantitatively the number and locations of spectral bands required to perform general rock-type discrimination from spaceborne imaging sensors using only thermal infrared measurements. Beginning with laboratory spectra collected under idealized conditions from relatively well characterized, homogeneous samples, a radiative transfer model was employed to transform ground exitance values into the corresponding spectral radiance at the top of the atmosphere. Taking sensor noise into account analysis of these data revealed that three 1 micrometer wide spectral bands would permit independent estimators of rock-type and sample temperature from a satellite infrared multispectral scanner. This study, indicates that the location of three spectral bands at 8.1-9.1 micrometers, 9.5-10.5 micrometers and 11.0-12.0 micrometers, and the employment of appropriate preprocessing to minimize atmospheric effects makes it possible to predict general rock-type and temperature for a variety of atmospheric states and temperatures. Author

N79-11450# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PRELIMINARY GEOLOGICAL PRECAMBRIAN MAP OF PIAUI [MAPA GEOLOGICO PRELIMINAR DO PRECAMBRIANO DO PIAUI]
Edison Crepani, Paulo Roberto Martini, Paulo Veneziani, Augusto PaivaFilno, and Moacir Moco Oct. 1977 22 p refs In PORTUGUESE; ENGLISH summary
(INPE-1146-PE/099) Avail: NTIS HC A02/MF A01

A preliminary geological precambrian map was done using LANDSAT images and SLAR mosaics of the project RADAM/BRAZIL. The map is presented in three parts which correspond to the South, the East and the North of the State. B.B.

N79-11451*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SEPARABILITY OF AGRICULTURAL COVER TYPES IN SPECTRAL CHANNELS AND WAVELENGTH REGIONS

Ravindra Kumar Oct. 1977 21 p refs
(Grant NGL-15-005-112)
(NASA-CR-157803; INPE-1147-PE/100) Avail: NTIS HC A02/MF A01 CSCL 02C

Spectral channels and wavelength regions (visible, near infrared, middle infrared and thermal infrared) were evaluated with respect to their estimated probability of correct classification (Pc) in discriminating agricultural cover types. Multispectral scanner data in twelve spectral channels in the wavelength range of 0.4 to 11.7 microns acquired in the middle of July for three flightlines, were analyzed by applying automatic pattern recognition techniques. The same analysis was performed for the data acquired in the middle of August, 1971, over the same three flightlines, to investigate the effect of time on the results. The effect of deletion of each spectral channel as well as each wavelength region on Pc is given. Values of Pc for all possible combinations of wavelength regions in the subsets of one to twelve spectral channels are also given. The overall values of Pc were found to be greater for the data of the middle of August than the data of the middle of July. S.B.S.

N79-11452# Army Engineer Topographic Labs., Fort Belvoir, Va.
TEST OF MAP-READ MAGNETIC DECLINATION ACCURACY
Glenn W. Schmeidel May 1978 29 p refs
(AD-A056007; ETL-0148) Avail: NTIS HC A03/MF A01 CSCL 08/2

This report covers a test of how accurately a map-referenced magnetic declination represents the actual magnetic declination found by measuring true north and magnetic north at various points selected at random within the mapped area. The undeveloped area in Quantico, Virginia was investigated and found to have individual variations as great as 23 mils, with a 1-sigma standard deviation of 8 mils from the map-read value.
Author (GRA)

N79-11453# Oak Ridge National Lab., Tenn.
COMPUTER PROGRAM TO PLOT ISOTHERMS IN BODIES OF WATER. ENVIRONMENTAL SCIENCES DIVISION PUBLICATION NO. 1199
D. L. Deangelis Jun. 1978 46 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6395) Avail: NTIS HC A03/MF A01

A computer code was developed to graphically display temperature versus depth data in bodies of water in the form of isotherms (lines of equal temperature). The procedure assumes that the temperature can be linearly interpolated between the points at which measurements are taken. Details of the code are explained by means of examples. With minor changes, the program can be used to plot isoclines of other environmental parameters. DOE

N79-11454# Petroleum Industry Research Foundation, Inc., New York.
OUTLOOK FOR WORLD OIL INTO THE 21ST CENTURY WITH EMPHASIS ON THE PERIOD TO 1990 Final Report
John H. Lichtblau and H. J. Frank May 1978 180 p refs Sponsored by Electric Power Research Inst. Prepared in cooperation with Arizona Univ.
(EPRI-EA-745; SOA-76-328) Avail: NTIS HC A09/MF A01

A forecast is presented of oil supply and demand in the non-Communist world for two periods: 1976 to 1990 and 1990 to 2005. Oil is treated as the energy supply of last resort, the balancing item, with special emphasis on oil from the Organization of Petroleum Exporting Countries (OPEC). Energy demand, based on forecast economic growths and energy/economic growth relationships is projected. This demand is assumed to be met to the maximum feasible extent from non-oil energy supplies (coal, gas, nuclear power, hydro and geothermal power, and other sources). The resultant total oil demand is then met first from non-OPEC oil supplies, in order to test the demand for and adequacy of OPEC oil supplies under different energy demand scenarios. The findings are that a gradual transition to non-oil sources of energy over the next 25 to 30 years is more likely than an extended oil shortage of crisis proportions. DOE

N79-11455# Forschungsinstitut fuer Hochfrequenzphysik, Werthhoven (West Germany).
MILLIMETER WAVE IMAGING OF GROUND BASED OBJECTS
H. Gniss and K. Magura Jan. 1978 58 p refs In GERMAN; ENGLISH summary
(Contract BMVg-GF-76/77)
(Rept-1-78) Avail: NTIS HC A04/MF A01

Problems concerning the recognizability of millimeter wave images obtained from various targets (models of ground based objects) at 36 GHz in laboratory experiments are dealt with. The dependence of image fidelity on lateral resolution of the mapping aperture and the form, orientation, and depolarization properties of the target are discussed. Because of the spatial distribution of only a limited number of scattering centers on the object, which depend on aspect angle and polarization generally, the image fidelity is affected strongly. Smoothing of the resulting image intensity fluctuations was obtained by incoherent superposition of independent partial images. The image disturbances resulting from ground and environment clutter were investigated. Author (ESA)

N79-11456# European Space Agency, Paris (France).
ANALYSIS OF A REMOTE SENSING PAYLOAD FOR THE SPACELAB D3 MISSION (PRELIMINARY PHASE A) Final Report
F. Schlude Jun. 1978 129 p refs Transl. into ENGLISH of 'Untersuch. zu einer Fernerkundungsnutzlast fuer die Spacelab-Mission D3', DFVLR, Oberpfaffenhofen, West Ger. Report DLR-IB-551-77/8, Dec. 1977
(ESA-TT-482; DLR-IB-551-77/8) Avail: NTIS HC A07/MF A01

A remote sensing payload for atmospheric physics and earth sensing for the Spacelab D3 mission is proposed. Topics include scientific and technological objectives, experiment selection, experimental hardware, and mission-dependent equipment. The following equipment is discussed: metric camera focal length 30 or 60 cm; mechanical scanner, 7 channels, 17 deg aperture angle; push-broom scanner, 4 channels, 4.3 deg aperture angle; microwave experiment of the first Spacelab payload, 9.6 GHz; and SAR facility, 2 frequencies, 2 polarizations, fixed angle of depression. It is concluded that the mechanical accomodation can be achieved without any problems, the electrical primary powers can be supplied, the thermal balance sheet problems can be regarded as soluble, and the data handling, both aboard Spacelab and in the transition section, can be solved only by a reduction of the operating periods. ESA

N79-11457# European Space Agency, Paris (France).
THE COVERAGE FIELD OF EARTH OBSERVATION SATELLITES AT THE EARTH'S SURFACE. DESCRIPTION OF THE COMPUTER PROGRAM COFI
E. Fritz Jochim and W. Pawlik Aug. 1978 77 p refs Transl. into ENGLISH of 'Das Ueberdeckungsfeld erdbeobachtender Satelliten auf der Erdoberflaeche. Beschreibung des Rechnerprogramms COFI', DFVLR, Oberpfaffenhofen, West Ger. Report DLR-IB-552-77/40, 1977 Original report in GERMAN previously announced as N78-31516
(ESA-TT-487; DLR-IB-552-77/40) Avail: NTIS HC A05/MF A01

The computer program described produces a printer plot of the coverage field and coverage frequency within a given period in geographical coordinates or in geographical latitude against the mean solar time. Nadir angle and half width of the perpendicular to the orbit scanning sensor may be chosen freely. Multiply-covered regions are made evident by a variable density or special characters. Restrictions are possible on mean local solar time intervals. The subsatellite curve can be represented with the Local Mean Time marked on the curve. The program aids in the mission analysis of earth observation satellites.
Author (ESA)

N79-11458# European Space Agency, Paris (France).
COVERAGE BEHAVIOR OF ERDSAT FOR SOME SELECTED AREAS OF THE EARTH'S SURFACE
E. F. Jochim Aug. 1978 76 p refs Transl. into ENGLISH of 'Ueberdeckungsverhalten des ERDSAT fuer einige ausgewaehlte Gebiete auf der Erdoberflaeche', DFVLR, Oberpfaffenhofen, West

Ger. Report DLR-IB-552-78/1 Mar. 1978 Original report in GERMAN previously announced as N78-29548
(ESA-TT-494; DLR-IB-552-78/1) Avail: NTIS HC A05/MF A01

The coverage behavior of a proposed European remote sensing satellite was investigated for each of its onboard sensors for Europe, the Amazon basin, Indonesia, and Brazil. The proposed satellite will carry a multispectral scanner and a microwave sensor. It is concluded that the satellite orbit can be optimal only for one sensor for one region on the earth. ESA

N79-11459# National Oceanic and Atmospheric Administration, Washington, D. C. Office of Coastal Zone Management.
STATE OF NORTH CAROLINA COASTAL MANAGEMENT PROGRAM AND DRAFT ENVIRONMENTAL IMPACT STATEMENT, VOLUME 1
Mar. 1978 293 p Prepared in cooperation with N. Carolina Dept. of Nat. and Econ. Res. 2 Vol.
(PB-283588/2; NOAA-78060506) Avail: NTIS HC A13/MF A01 CSCL 13B

The National Environmental Policy Act (NEPA) of 1969 mandates that an environmental impact statement be prepared as part of the review and approval process of major actions by Federal government agencies which significantly affect the quality of the human environment. The draft environmental impact statement and program document are included. GRA

N79-11460# National Oceanic and Atmospheric Administration, Washington, D. C. Office of Coastal Zone Management.
STATE OF NORTH CAROLINA COASTAL MANAGEMENT PROGRAM AND DRAFT ENVIRONMENTAL IMPACT STATEMENT. VOLUME 2: APPENDICES
Mar. 1978 624 p Prepared in cooperation with N. Carolina Dept. of Nat. and Econ. Res. 2 Vol
(PB-283589/0; NOAA-78060507) Avail: NTIS HC A99/MF A01 CSCL 13B

The National Environmental Policy Act (NEPA) of 1969 mandates that an environmental impact statement be prepared as part of the review and approval process of major actions by Federal government agencies which significantly affect the quality of the human environment. The appendices to the program are included. GRA

N79-11461# Gulf South Research Inst., Baton Rouge, La.
BARRIER ISLANDS OF THE ATLANTIC AND GULF COASTS OF THE UNITED STATES: AN ANNOTATED BIBLIOGRAPHY
Jacques D. Bagur Apr. 1978 230 p refs
(Contract DI-14-16-0008-2113)
(PB-283145/1; FWS/OBS-77/56) Avail: NTIS HC A11/MF A01 CSCL 08F

Published information on the barrier islands along the Atlantic and Gulf of Mexico coasts was compiled. Barrier islands are defined as elongated land formations, composed of unconsolidated materials, and lying parallel to the shoreline, including spits and mangrove barrier islands. Descripitve information on the physical features and the fish and wildlife resources of barrier islands cited will provide background materials for the development of a Federal/state/local strategy to protect this valuable, fragile component of the coastal ecosystem. The bibliography was arranged geographically by state and island from Maine to Texas. Author and subject indexes were included for the 953 annotated references. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N79-11462 Virginia Polytechnic Inst. and State Univ., Blacksburg.
ANALYTICAL METHODS FOR EVALUATING TWO-DIMENSIONAL EFFECTS IN FLAT-PLATE SOLAR COLLECTORS Ph.D. Thesis
Clifford Keith Rice 1978 202 p
Avail: Univ. Microfilms Order No. 7818557

Two methods of absorber plate thermal analysis which can be used within the framework of existing theory were developed. The first method used the separation of variables technique in a unique manner to solve exactly for the coupled axial and transverse temperature distributions in an absorber plate-tube assembly. The conventional assumption of an overall uniform loss coefficient U sub L was used in the analysis. The first method is practical only for the parallel-flow collectors. The second method used two sectionally uniform loss coefficients U sub Li for internal collector sections and U sub Le for edge sections to evaluate collector performance. The second method is applicable for both parallel flow and serpentine configurations. The solution technique developed in the first method has potential applications to a number of conduction-convection problems. The second method has the inherent capability to better evaluate performance and design questions related to edge effects. Dissert. Abstr.

N79-11463 California Univ., Santa Barbara.
SCHOTTKY BARRIER SOLAR CELLS Ph.D. Thesis
Akbar Adibi 1977 192 p
Avail: Univ. Microfilms Order No. 7818732

Metal-Insulator-Semiconductor Schottky diodes were fabricated on p-type silicon using a thin titanium layer as a metal contact. A diffusion-pump evaporation system and an electron-beam evaporation system were used for Ti evaporation. Electrical and optical properties of the Ti thin film were found to depend significantly on the rate of the evaporation. A slow rate of evaporation resulted in much higher resistivity, lower reflection coefficient and higher transmission coefficient than those for the fast rate of evaporation. Also, it was found that the slow rate of evaporation resulted in an instability in the electrical and optical properties of the film. A method was established for measurement of the thin-metal film thickness. Dissert. Abstr.

N79-11464 Texas Univ. at Austin.
SOLID DESICCANT AIR CONDITIONING WITH SILICA GEL USING SOLAR ENERGY Ph.D. Thesis
Fernando Enrique Pla Barby 1978 223 p
Avail: Univ. Microfilms Order No. 7817695

A solid desiccant air dryer was modeled numerically and checked against experimental data and other analytical and experimental models. The parameters that control the air dryer performance were determined and the performance data for the silica gel system were presented in terms of these parameters based on the modeling results. The numerical model was used in an investigation of solid desiccant air conditioning using silica gel as the desiccant and solar energy at low temperature (150 F) to regenerate the desiccant. Several combinations of air dryers, heat exchangers and evaporative coolers were analyzed and their performance calculated. It was determined that, although solid desiccant air conditioning is feasible, a regeneration temperature of 150 F is really the lowest that may be used and should be increased as much as possible to improve the performance of the air dryer. Dissert. Abstr.

N79-11465 Georgia Inst. of Tech., Atlanta.
THERMAL ANALYSIS OF RECEIVERS FOR SOLAR CONCENTRATORS AND OPTIMIZATION PROCEDURE FOR POWER PRODUCTION Ph.D. Thesis
Prakash Rao Damshala 1978 193 p
Avail: Univ. Microfilms Order No. 7819520

The particular linear concentrator used is the 540 sq ft prototype faceted fixed mirror concentrator at Georgia Tech, which utilizes the fixed mirror moving receiver. The thermal analysis of the collector utilizing an evacuated receiver is described which predicts the thermal efficiency of the receiver and exit temperature of the collector fluid. Therminol 66 is the heat transfer fluid. A linear equation is obtained for the thermal efficiency of the receiver for arbitrary values of solar intensity, inlet temperature and ambient temperature. A solar/fossil power plant of 100MW was designed to illustrate the procedure for optimizing the system for the least cost unit power produced. A Rankin cycle using

toluene as the working fluid is coupled to the collector circuit. Pertinent component models and heat balance equations are included. A procedure is outlined to optimize the entire system.
Dissert. Abstr.

N79-11466* National Aeronautics and Space Administration, Washington, D. C.
ENERGY. A CONTINUING BIBLIOGRAPHY WITH INDEXES, ISSUE 18
Aug. 1978 448 p
(NASA-SP-7043-18) Avail: NTIS HC E07 CSCL 10B

This issue of Energy lists 1038 reports, journal articles, and other documents announced between April 1, 1978 and June 30, 1978 in Scientific and Technical Aerospace Reports (STAR) or in International Aerospace Abstracts (IAA). The coverage includes regional, national and international energy systems; research and development on fuels and other sources of energy; energy conversion, transport, transmission, distribution and storage, with special emphasis on use of hydrogen and of solar energy. Also included are methods of locating or using new energy resources. Of special interest is energy for heating, lighting, for powering aircraft, surface vehicles, or other machinery. G.Y.

N79-11467* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLAR CELLS HAVING INTEGRAL COLLECTOR GRIDS Patent
John C. Evans, Jr., inventor (to NASA) Issued 1 Aug. 1978 7 p Filed 6 Jun. 1977 Supersedes N77-24593 (15 - 15, p 2011)
(NASA-Case-LEW-12819-1; US-Patent-4,104,084;
US-Patent-Appl-SN-803823; US-Patent-Class-136-89CC;
US-Patent-Class-136-89SJ; US-Patent-Class-357-15;
US-Patent-Class-357-16; US-Patent-Class-357-30;
US-Patent-Class-357-65; US-Patent-Class-357-67) Avail: US Patent Office CSCL 10A

A heterojunction or Schottky barrier photovoltaic device is described, comprising a conductive base metal layer. A back surface field region was formed at the interface between the device and the base metal layer, a transparent, conductive mixed metal oxide layer in integral contact with the n-type layer of the heterojunction or Schottky barrier device. A metal alloy grid network was included. An insulating layer prevented electrical contact between the conductive metal base layer and the transparent, conductive metal oxide layer.
Official Gazette of the U.S. Patent Office

N79-11468* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF SEMICONDUCTOR DIFFUSANTS TO SOLAR CELLS BY SCREEN PRINTING Patent
John C. Evans, Jr., Henry W. Brandhorst, Jr., George A. Mazaris, and Larry R. Scudder, inventors (to NASA) Issued 1 Aug. 1978 5 p Filed 20 May 1977 Supersedes N77-24589 (15 - 15, p 2010)
(NASA-Case-LEW-12775-1; US-Patent-4,104,091;
US-Patent-Appl-SN-799026; US-Patent-Class-148-188;
US-Patent-Class-29-572; US-Patent-Class-136-89;
US-Patent-Class-427-75) Avail: US Patent Office CSCL 10A

Diffusants were applied onto semiconductor solar cell substrates, using screen printing techniques. The method was applicable to square and rectangular cells and can be used to apply dopants of opposite types to the front and back of the substrate. Then, simultaneous diffusion of both dopants can be performed with a single furnace pass.
Official Gazette of the U.S. Patent Office

N79-11469* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD FOR MAKING AN ALUMINUM OR COPPER SUBSTRATE PANEL FOR SELECTIVE ABSORPTION OF SOLAR ENERGY Patent
Marion L. Roberts, Max H. Sharpe, and Albert C. Krupnick, inventors (to NASA) Issued 1 Aug. 1978 7 p Filed 31 Aug. 1977 Supersedes N77-31610 (15 - 22, p 2960)
(NASA-Case-MFS-23518-1; US-Patent-4,104,134;
US-Patent-Appl-SN-829390; US-Patent-Class-204-37R;
US-Patent-Class-204-32; US-Patent-Class-204-33;
US-Patent-Class-204-38B) Avail: US Patent Office CSCL 10A

A panel is described for selectively absorbing solar energy comprising an aluminum substrate. A zinc layer was covered by a layer of nickel and an outer layer of solar energy absorbing nickel oxide or a copper substrate with a nickel layer. A layer of solar energy absorbing nickel oxide distal from the copper substrate was included. A method for making these panels is disclosed. Official Gazette of the U.S. Patent Office

N79-11470* National Aeronautics and Space Administration. Pasadena Office, Calif.
SOLAR PHOTOLYSIS OF WATER Patent
Porter R. Ryason, inventor (to NASA) (JPL) Issued 8 Aug. 1978 7 p Filed 30 Sep. 1977 Supersedes N78-11500 (16 - 02, p 0212) Sponsored by NASA
(NASA-Case-NPO-14126-1; US-Patent-4,105,517;
US-Patent-Appl-SN-838336; US-Patent-Class-204-157.1R;
US-Patent-Class-250-527) Avail: US Patent Office CSCL 10A

A cyclic process is described for the solar photolysis of water, including a first stage in which water is reduced in the presence of a Eu(+2) photooxidizable reagent producing hydrogen and spent oxidized Eu(+3) reagent. The spent reagent Eu(+3) is reduced by means of a transition metal ligand complex reductant, RuL(+3) in a photoexcited state, such as a ruthenium pyridyl complex. Due to competing reactions between the photolysis and regeneration products, the photooxidation reaction must be separated from the regeneration in space and time by supporting the reagent and/or the reductant on solid supports and utilizing pH, wavelength and flow control to maximize hydrogen and oxygen production. Official Gazette of the U.S. Patent Office

N79-11471* National Aeronautics and Space Administration. Pasadena Office, Calif.
NON-TRACKING SOLAR ENERGY COLLECTOR SYSTEM Patent
M. Kudret Selcuk, inventor to NASA (JPL) Issued 31 Oct. 1978 8 p Filed 27 May 1977 Supersedes N77-28583 (15 - 19, p 2550) Continuation-in-part of US Patent Appl SN-765139, filed 3 Feb. 1977, US Patent 4,091,798 Sponsored by NASA
(NASA-Case-NPO-13817-1; US-Patent-4,122,833;
US-Patent-Appl-SN-801452; US-Patent-Class-126-271;
US-Patent-Class-126-270; US-Patent-Class-350-288;
US-Patent-Class-350-299; US-Patent-4,091,798; US-Patent-Appl-SN-765139) Avail: US Patent Office CSCL 10A

A solar energy collector system is described characterized by an improved concentrator for directing incident rays of solar energy on parallel strip-like segments of a flatplate receiver. Individually mounted reflector modules of a common asymmetrical triangular cross-sectional configuration supported for independent orientation are asymmetric included with vee-trough concentrators for deflecting incident solar energy toward the receiver.
Official Gazette of the U.S. Patent Office

N79-11472* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SOLAR CELL COLLECTOR AND METHOD FOR PRODUCING SAME Patent
John C. Evans, Jr., inventor (to NASA) Issued 24 Oct. 1978 5 p Filed 21 Oct. 1977 Division of US Patent Appl. SN-770869, Filed 22 Feb. 1977, US Patent-4,082,569
(NASA-Case-LEW-12552-2; US-Patent-4,122,214;
US-Patent-Appl-SN-844346; US-Patent-Class-427-75;
US-Patent-Class-427-84; US-Patent-Class-427-123;
US-Patent-Class-427-126; US-Patent-Class-427-261;
US-Patent-Class-427-343; US-Patent-Class-427-398A;
US-Patent-Class-427-399; US-Patent-Class-29-572;
US-Patent-4,082,569; US-Patent-Appl-SN-770869) Avail: US Patent Office CSCL 10A

A transparent, conductive collector layer containing conductive metal channels is formed as a layer on a photovoltaic substrate by coating a photovoltaic substract with a conductive mixed metal layer. A heat sink having portions protruding from one of its surfaces is attached. These protruding portions define a continuous pattern in combination with recessed regions among them such that they are in contact with the conductive layer of

the photovoltaic substrate. Heating the substrate while simultaneously oxidizing the portions of the conductive layer exposed to a gaseous oxidizing substance forced into the recessed regions of the heat sink, creates a transparent metal oxide layer on the substrate. A continous pattern of highly conductive metal channels is contained in the metal oxide layer.

Official Gazette of the U.S. Patent Office

N79-11473*# Rocket Research Corp., Redmond, Wash.

APPLICATIONS OF THERMAL ENERGY STORAGE TO PROCESS HEAT AND WASTE HEAT RECOVERY IN THE IRON AND STEEL INDUSTRY Final Report, Sep. 1977 - Sep. 1978

Lincoln B. Katter and Daniel J. Peterson Oct. 1978 136 p refs Sponsored by NASA

(Contracts EC-77-C-01-5081; EC-77-A-31-1034)

(NASA-CR-159397; RRC-78-R-607; CONS/5081-1) Avail: NTIS HC A07/MF A01 CSCL 10A

The system identified operates from the primary arc furnace evacuation system as a heat source. Energy from the fume stream is stored as sensible energy in a solid medium (packed bed). A steam-driven turbine is arranged to generate power for peak shaving. A parametric design approach is presented since the overall system design, at optimum payback is strongly dependent upon the nature of the electric pricing structure. The scope of the project was limited to consideration of available technology so that industry-wide application could be achieved by 1985. A search of the literature, coupled with interviews with representatives of major steel producers, served as the means whereby the techniques and technologies indicated for the specific site are extrapolated to the industry as a whole and to the 1985 time frame. The conclusion of the study is that by 1985, a national yearly savings of 1.9 million barrels of oil could be realized through recovery of waste heat from primary arc furnace fume gases on an industry-wide basis. Economic studies indicate that the proposed system has a plant payback time of approximately 5 years. L.S.

N79-11474*# National Aeronautics and Space Administration, Washington, D. C.

PROGRAM THEK ENERGY PRODUCTION UNITS OF AVERAGE POWER AND USING THERMAL CONVERSION OF SOLAR RADIATION

Nov. 1978 16 p refs Transl. into ENGLISH of "Programme Thek, Unites de Production d'Energie de Moyenne Puissance par Conversion Thermique du Rayonnement Solaire" Centre National de la Recherche, Marseilles, Sep. 1977 6 p Transl. by Scientific Translation Service, Santa Barbara, Calif.

(Contract NASw-3198)

(NASA-TM-75369) Avail: NTIS HC A02/MF A01 CSCL 10A

General studies undertaken by the C.N.R.S. in the field of solar power plants have generated the problem of building energy production units in the medium range of electrical power, in the order of 100 kW. Among the possible solutions, the principle of the use of distributed heliothermal converters has been selected as being, with the current status of things, the most advantageous solution. This principle consists of obtaining the conversion of concentrated radiation into heat by using a series of heliothermal conversion modules scattered over the ground; the produced heat is collected by a heat-carrying fluid circulating inside a thermal loop leading to a device for both regulation and storage. L.S.

N79-11475*# Rockwell International Corp., Downey, Calif. Satellite Systems Div.

SATELLITE POWER SYSTEMS (SPS) CONCEPT DEFINITION STUDY (EXHIBIT C) Quarterly Review No. 2

G. M. Hanley Sep. 1978 446 p

(Contract NAS8-32475)

(NASA-CR-150827; SD-78-AP-0115) Avail: NTIS HC A19/MF A01 CSCL 10A

A coplanar satellite conceptual approach was defined. This effort included several trade studies related to satellite design and also construction approaches for this satellite. A transportation system, consistent with this concept, was also studied, including an electric orbit transfer vehicle and a parallel-burn heavy lift launch vehicle. Work on a solid state microwave concept continued and several alternative approaches were evaluated. Computer determination of an optimized transistor and circuit design was also continued. Experiment/verification planning resulted in the development of a total solar array and microwave technology development plan, as well as definition of near-term research to evaluate key technology issues. G.Y.

N79-11476*# AiResearch Mfg. Co., Torrance, Calif.

DESIGN AND FABRICATION OF THE MINI-BRAYTON RECUPERATOR (MBR) Final Report, Mar. 1974 - Jul. 1978

J. J. Killackey, R. Graves, and G. Mosinskis Apr. 1978 99 p refs

(Contract NAS3-18029)

(NASA-CR-159429; AiResearch-78-14972) Avail: NTIS HC A05/MF A01 CSCL 10B

Development of a recuperator for a 2.0 kW closed Brayton space power system is described. The plate-fin heat exchanger is fabricated entirely from Hastelloy X and is designed for 10 years continuous operation at 1000 K (1300 F) with a Xenon-helium working fluid. Special design provisions assure uniform flow distribution, crucial for meeting 0.975 temperature effectiveness. Low-cycle fatigue, resulting from repeated startup and shutdown cycles, was identified as the most critical structural design problem. It is predicted that the unit has a minimum fatigue life of 220 cycles. This is in excess of the BIPS requirement of 100 cycles. Heat transfer performance and thermal cycle testing with air, using a prototype unit, verified that all design objectives can be met. Author

N79-11477*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OPTIMUM DRY-COOLING SUB-SYSTEMS FOR A SOLAR AIR CONDITIONER

James L. S. Chen and David Namkoong Oct. 1978 41 p refs

(NASA-TM-79007; E-9788) Avail: NTIS HC A03/MF A01 CSCL 10A

Dry-cooling sub-systems for residential solar powered Rankine compression air conditioners were economically optimized and compared with the cost of a wet cooling tower. Results in terms of yearly incremental busbar cost due to the use of dry-cooling were presented for Philadelphia and Miami. With input data corresponding to local weather, energy rate and capital costs, condenser surface designs and performance, the computerized optimization program yields design specifications of the subsystem which has the lowest annual incremental cost. Author

N79-11478*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PRELIMINARY SUMMARY OF THE ETF CONCEPTUAL STUDIES

George R. Seikel, Robert W. Bercaw, C. Victor Pearson (Argonne Natl. Lab.), and William R. Owens (Gilbert Assoc., Inc.) 1978 20 p refs Presented at the 4th US-USSR Colloq. on MHD Elec. Power Generation, Washington, D. C., 5-6 Oct. 1978

(Contract EF-77-A-01-2674)

(NASA-TM-78999; E-9783; DOE/NASA/2674-78/1) Avail: NTIS HC A02/MF A01 CSCL 10A

Power plant studies have shown the attractiveness of MHD topped steam power plants for baseload utility applications. To realize these advantages, a three-phase development program was initiated. In the first phase, the engineering data and experience were developed for the design and construction of a pilot plant, the Engineering Test Facility (ETF). Results of the ETF studies are reviewed. These three parallel independent studies were conducted by industrial teams led by the AVCO Everett Research Laboratory, the General Electric Corporation, and the Westinghouse Corporation. A preliminary analysis and the status of the critical evaluation of these results are presented. L.S.

N79-11479*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

SUPPLY OF REACTANTS FOR REDOX BULK ENERGY STORAGE SYSTEMS Final Report

Randall F. Gahn Sep. 1978 12 p refs

(Contract E(49-28)-1002)

(NASA-TM-78995; E-9779; DOE/NASA/1002-78/1) Avail: NTIS HC A02/MF A01 CSCL 10A

World resources, reserves, production, and costs of reactant materials, iron, chromium, titanium and bromine for proposed redox cell bulk energy storage systems are reviewed. Supplying required materials for multimegawatt hour systems appears to be feasible even at current production levels. Iron and chromium ores are the most abundant and lowest cost of four reactants. Chromium is not a domestic reserve, but redox system installations would represent a small fraction of U.S. imports. Vast quantities of bromine are available, but present production is low and therefore cost is high. Titanium is currently available at reasonable cost, with ample reserves available for the next fifty years.
S.B.S.

N79-11480*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CORRELATIONS OF CATALYTIC COMBUSTOR PERFORMANCE PARAMETERS
Daniel L. Bulzan Oct. 1978 15 p refs Presented at the 3d Workshop on Catalytic Combust., Asheville, N. C., 3-4 Oct. 1978; sponsored by EPA
(Contract EC-77-A-31-1040)
(NASA-TM-79014; E-9803; DOE/NASA/1040-78/4) Avail: NTIS HC A02/MF A01 CSCL 10A

Correlations for combustion efficiency percentage drop and the minimum required adiabatic reaction temperature necessary to meet emissions goals of 13.6 g CO/kg fuel and 1.64 g HC/kg fuel are presented. Combustion efficiency was found to be a function of the cell density, cell circumference, reactor length, reference velocity, and adiabatic reaction temperature. The percentage pressure drop at an adiabatic reaction temperature of 1450 K was found to be proportional to the reference velocity to the 1.5 power and to the reactor length. It is inversely proportional to the pressure, cell hydraulic diameter, and fractional open area. The minimum required adiabatic reaction temperature was found to increase with reference velocity and decrease with cell circumference, cell density and reactor length. A catalyst factor was introduced into the correlations to account for differences between catalysts. Combustion efficiency, the percentage pressure drop, and the minimum required adiabatic reaction temperature were found to be a function of the catalyst factor. The data was from a 12 cm-diameter test rig with noble metal reactors using propane fuel at an inlet temperature of 800 K.
S.B.S.

N79-11481*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL STORAGE FOR INDUSTRIAL PROCESS AND REJECT HEAT
R. A. Duscha and W. J. Masica 1978 14 p refs Presented at the 2d Conf. on Waste Heat Management and Util., Miami Beach, Fla., 4-6 Dec. 1978
(Contract EC-77-A-31-1034)
(NASA-TM-78994; E-9777; DOE/NASA/1034-78/3) Avail: NTIS HC A02/MF A01 CSCL 10A

Industrial production uses about 40 percent of the total energy consumed in the United States. The major share of this is derived from fossil fuel. Potential savings of scarce fuel is possible through the use of thermal energy storage (TES) of reject or process heat for subsequent use. Three especially significant industries where high temperature TES appears attractive - paper and pulp, iron and steel, and cement are discussed. Potential annual fuel savings, with large scale implementation of near-term TES systems for these three industries, is nearly 9,000,000 bbl of oil.
S.B.S.

N79-11482# Naval Nuclear Power Unit, Port Hueneme, Calif.
RADIOISOTOPE THERMOELECTRIC GENERATORS OF THE US NAVY, VOLUME 10 Final Report, 1 Jan. 1976 - 1 Jul. 1978
1 Jul. 1978 84 p
(AD-A057483) Avail: NTIS HC A05/MF A01 CSCL 10/2

This document disseminates information on the development and application of radioisotope thermoelectric generators (RTGs) within the Navy. A chapter is included which describes what an RTG is, how it operates, and generally when it can be used. Other chapters examine potential applications in more depth, summarize current RTG missions, and describe the Navy's latest development effort, the half-watt RTG. A chapter is also devoted to providing technical information such as electrical power output and current/voltage characteristics for each model of RTG in the Navy's inventory. For those engineers and scientists in search of a long life, reliable power source instructions on how to obtain an RTG and a listing of services available from the Naval Nuclear Power Unit are provided. A table is presented which lists RTGs in the Navy's inventory that are not presently assigned to missions and are available for loan. Author (GRA)

N79-11483# American Univ., Washington, D. C.
THE PREPARATION OF SOME NOVEL ELECTROLYTES: SYNTHESIS OF PARTIALLY FLUORINATED ALKANE SULFONIC ACIDS AS POTENTIAL FUEL CELL ELECTROLYTES Interim Technical Report
Chaiyun Bunyagidj and M. H. Aldridge Mar. 1978 29 p refs (Contract DAAK70-77-C-0047; DA Proj. 1L1-61102-A-H51)
(AD-A056278; TR-1) Avail: NTIS HC A03/MF A01 CSCL 10/2

The objective of this research was to prepare some strong acids for evaluation by Fort Belvoir as potential fuel cell electrolytes. The only acid other than phosphoric, H3PO4, currently under investigation by Fort Belvoir as a fuel cell electrolyte is TFMSA, CF3SO3H.H2O, trifluoromethanesulfonic acid monohydrate aqueous solutions and sodium salt mixtures. TFMSA has been found to be superior to H3PO4 from the standpoint of electrode kinetics, but certain undesirable characteristics (volatility wetting of Teflon) led to this search for a better fuel cell electrolyte. The following acids were prepared: Methanedisulfonic acid; Ethanesulfonic acid; Ethane-1,2-disulfonic acid; Propane-1,3-disulfonic acid; Propane-1,2,3-trisulfonic acid; Chlorotrifluoroethanesulfonic acid; and 1,2,2-trifluoroethane-1,1,2-trisulfonic acid. Yields were low because of purification difficulties and future work will be concerned with scaling up the preparations. GRA

N79-11484# Army Construction Engineering Research Lab., Champaign, Ill.
INVESTIGATION OF REFLECTIVE SOLAR CONTROL FILMS FOR WINDOWS
Stanley M. Kanarowski 1 Jun. 1978 86 p refs
(AD-A056620; CERL-SR-M-240) Avail: NTIS HC A05/MF A01 CSCL 13/13

This report presents the results of a study of flexible solar control film applied on windows to eliminate or reduce glare and solar heat, and to conserve energy. Four manufacturers' films were investigated by surveying users in 15 areas of the United States, visiting selected installations, and conducting a laboratory evaluation of film/glass samples. In addition, solar radiation heat balance profiles were developed to indicate the solar heat gain through clear glass with and without solar film. A computer heating and cooling load and systems simulation program was run on a typical 72 man barracks module. Annual heating and cooling loads and costs and the related life-cycle cost (LCC) for the barracks module were computed for several types of window glass, solar film on clear glass, and interior shading.
GRA

N79-11485# Army Mobility Equipment Research and Development Command, Fort Belvoir, Va.
HIGH ENERGY METAL HYDRIDE FUEL CELL POWER SOURCE
Walter G. Taschek and Cornelius E. Bailey, Jr. Jun. 1978 14 p refs
(AD-A056491) Avail: NTIS HC A02/MF A01 CSCL 10/2

A fuel cell is a device which produces electricity cleanly, silently and efficiently. Like the familiar dry cells and lead acid batteries, fuel cells work by virtue of electrochemical reactions in which the energy of a fuel and an oxidant are directly transformed into direct current electricity. Unlike batteries, however, fuel cells do not consume the chemicals that are part of or stored within their structure. The reactant chemicals used by fuel cells are supplied from an external source. This feature, in principle, allows the fuel cell to operate as long as fuel and oxidant are supplied and reaction products removed. GRA

N79-11486# Naval Postgraduate School, Monterey, Calif.
PRELIMINARY DESIGN AND ANALYSIS OF A TOTAL ENERGY SYSTEM FOR MASSACHUSETTS INSTITUTE OF TECHNOLOGY M.S. Thesis

Webster Lance Benham Sep. 1977 219 p refs
(AD-A057289) Avail: NTIS HC A10/MF A01 CSCL 10/3

The total energy system concept has been proposed as a possible means of reducing the cost of providing electricity at M.I.T. An overview of key factors influencing the possible shift to a total energy system approach is presented. Campus steam and electrical load profiles are defined and the dependence of load upon ambient temperature is analyzed. Load growth and the future impact of conservation measures at M.I.T. are addressed in relation to the relative sizing of a proposed total energy plant. A demand model is constructed for use in simulating the operation of alternative total energy designs on a computer. A comparison of 1976 consumption data at M.I.T. with that predicted by the load model is made, establishing the validity of the model for further use in total energy system simulation. Methods of modeling different equipment configurations are discussed for the purpose of devising computer programs to aid in comparative cost studies. Author (GRA)

N79-11487# Oak Ridge National Lab., Tenn.
TRANSPORTATION ENERGY CONSERVATION DATA BOOK, EDITION 2
D. B. Shonka, A. S. Loebl, and P. D. Patterson Oct. 1977 567 p refs
(Contract W-7405-eng-26)
(ORNL-5320) Avail: NTIS HC A24/MF A01

Energy data are presented for the various characteristics of transportation. Areas covered include projected transportation technologies, government impacts, district heating, utilization of waste heat from electric power generation, and on-site generation of electricity. DOE

N79-11488# Department of Energy, Oak Ridge, Tenn.
ENERGY INFORMATION DATA BASE. GUIDE TO ABSTRACTING AND INDEXING
Feb. 1978 110 p
(TID-4583-R1) Avail: NTIS HC A06/MF A01

The guidelines used in abstract writing and editing and in subject descriptor selection for five data bases are presented. The associated acquisition and subject categorization functions are also addressed. Three major data bases maintained are: the Energy Information Data Base, containing scientific and technical information covering all areas of energy as well as quasi-technical information in the area of energy policy and management; the General and Practical Information Base containing mass-distribution information on energy, how-to information primarily in the areas of energy conservation and solar energy utilization, and information on energy-related legislation and standards; and the Research in Progress Information Base, which describes current research and development programs in the field of energy. Two smaller, classified data bases are also produced, one on weapons data and the second containing other information that must be given limited distribution. DOE

N79-11489# National Association of Counties, Washington, D. C.
GUIDE TO REDUCING ENERGY-USE BUDGET COSTS
Apr. 1978 101 p refs Prepared in cooperation with Natl. League of Cities, Washington, D. C.
(Contract EM-75-C-01-8516)
(HCP/U60505-01) Avail: NTIS HC A06/MF A01

Improved buildings and vehicle fleets were studied as a means of energy conservation. A 48.1 percent saving in school buildings and a 59.7 percent saving in office buildings can be achieved with modifications of insulation, wiring, ventilation, and lighting systems. An average 30 percent saving can be achieved by lowering driving speeds from 70 to 50 mph. Energy-saving driving habits can cut fuel consumption by as much as 20 percent. Chapters included are: The Commitment to Energy Management; Employee Programs; Vehicle Fleets; New Buildings; and Existing Buildings. DOE

N79-11490# Public Service Electric and Gas Co., Newark, N. J.
BATTERY ENERGY STORAGE TEST (BEST) FACILITY. PHENOMENOLOGICAL CELL MODELING: A TOOL FOR PLANNING AND ANALYZING BATTERY TESTING AT THE BEST FACILITY
E. A. Hyman 21 Oct. 1977 101 p refs Prepared in cooperation with Public Serv. Elec. and Gas Res. Corp., Maplewood, N. J.
(COO-2857-1) Avail: NTIS HC A06/MF A01

Phenomenological cell modeling, a tool for battery testing is presented. The uses of modeling in the battery cycling test program are described. The modeling and modeling needs are discussed in more general terms. Areas in which modeling would be useful are listed. Succeeding sections are critical. Surveys of available technical information in each area are included. DOE

N79-11491# Department of Energy, Oak Ridge, Tenn.
ELECTRIC BATTERIES. A BIBLIOGRAPHY
1978 780 p
(TID-3361) Avail: NTIS HC A99/MF A01

This bibliography cites 5422 foreign and U.S. research reports, patents, articles, conference proceedings, and books relating to the electric batteries. Aspects covered include design and development; performance and testing; materials, components, and auxiliaries; and research in progress. Abstracts are included when available. If no abstract is provided, the subject descriptors used for computer storage and retrieval are given. Corporate author, personal author, subject, and report number indexes are included. DOE

N79-11492# Sandia Labs., Albuquerque, N. Mex.
REAL-TIME ENVIRONMENTAL AND PERFORMANCE TESTING OF CONCENTRATING PHOTOVOLTAIC ARRAYS
J. L. Watkins and D. A. Pritchard 1978 7 p refs Presented at IEEE Photovoltaic Specialists Conf., Washington, D. C., 5 Jun. 1978
(SAND-78-0918C; Conf-780619-6) Avail: NTIS HC A02/MF A01

The Photovoltaic Advanced Systems Test Facility is described. Several of the concentrating photovoltaic arrays tested are described along with their typical performance. An example of accelerated aging is given in which a concentrator module is exposed to severe temperature and humidity cycling, and the performance degradation is determined. Plans for future testing are given, including an expansion of the facility. DOE

N79-11493# AiResearch Mfg. Co., Los Angeles, Calif.
STUDY OF HEAT ENGINE/FLYWHEEL: HYBRID PROPULSION CONFIGURATION WITH ELECTRICAL TRANSMISSION SYSTEM. PHASE 2: DESIGN DEFINITION Final Report
Apr. 1978 28 p
(Contract EY-76-C-04-0789)
(ALO-41/2) Avail: NTIS HC A03/MF A01

Transmission options were evaluated and ranked according to cost, weight, and fuel economy. The vehicle used for the evaluation was a five-passenger family sedan. The primary use of this transmission system is to augment the heat engine with energy from the flywheel in such a manner as to level engine loads and improve the overall vehicle efficiency. It was determined that the ac-ac transmission system was the most attractive for vehicular applications in the weight range investigated. A comparison was made between a conventionally propelled (heat engine/automatic transmission) vehicle and the same vehicle configured with the hybrid propulsion arrangement that utilized the selected ac-ac transmission system. The results of this comparison were shown. The conventional vehicle had a curb weight of 3000 lb, whereas the same vehicle configured with the hybrid arrangement had a curb weight of 2866 lb. Both vehicles had the same acceleration and pass maneuver performance. The hybrid's fuel consumption was 39.5 mpg, compared to 15 mpg projected for the conventional vehicle. DOE

N79-11494# Los Alamos Scientific Lab., N. Mex.
AUGMENTED SOLAR ENERGY COLLECTION USING VARIOUS PLANAR REFLECTIVE SURFACES: THEORETICAL CALCULATIONS AND EXPERIMENTAL RESULTS
D. P. Grimmer, K. G. Zinn, K. C. Herr, and B. E. Wood Apr. 1978 39 p
(Contract W-7405-eng-36)
(LA-7041) Avail: NTIS HC A03/MF A01

The use of different types of flat reflective surfaces to increase the collection of solar energy by flat collectors was investigated. Specular, diffuse, and combination specular/diffuse reflective

surfaces are discussed. An attempt was made to describe the reflective properties of surfaces in more generalized terms than simple direct or simple diffuse. Most real surfaces possess a combination of specular-like and diffuse-like reflective properties. A computer model was generated to describe surfaces as a combination of specular- and diffuse-like reflectivities. The reflective properties of a given surface can be measured in the laboratory as a function of incident and reflected angles, and these measured reflective properties can be used in the computer model to predict the increase in collector performance with such a reflector. Predictions of system performance were made for various collector/reflector configurations and compared with the performance of an optimally oriented collector without a reflector. DOE

N79-11495# Sandia Labs., Albuquerque, N. Mex.
HELIOSTAT DUST BUILDUP AND CLEANING STUDIES
R. S. Berg Mar. 1978 35 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0510) Avail: NTIS HC A03/MF A01

Continuous cleaning using electrostatic repulsion has been tested in laboratory experiments and was shown to reduce dust accumulation. Periodic cleaning using high pressure sprays of up to 10,000 psi have been used to clean dirt from outdoor test samples. Tap water sprays at pressures above 500 psi seem to be equally effective and recover about 95% of the reflectance loss from dirt buildup. Several common detergents have been examined. Detergents with low pressure sprays generally must be used on short intervals, less than two weeks, or they lose their effectiveness. Measurements on accumulated dirt show that a limited number of measurements are required to characterize the optical loss of a dirty mirror. Weighted reflectivity measurements at 500 nm can be used. The dirt buildup is a very complex function of time and environmental conditions. DOE

N79-11496# Sandia Labs., Albuquerque, N. Mex.
SENSITIVITY OF SLOPE MEASUREMENTS ON PARABOLIC SOLAR MIRRORS TO POSITIONING AND ALIGNMENT OF THE LASER SCANNER
L. Rear Apr. 1978 28 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0700) Avail: NTIS HC A03/MF A01

Distinctive patterns of apparent error in the collector surface geometry are introduced by inaccuracies in three apparatus set up parameters: vertical position, angular alignment, and horizontal position. The studies allowed recognition of the subsequent compensation for the effects introduced by errors in the vertical position and the angular alignment, but the similarity between patterns generated by errors in the horizontal position and those due to deviations in parabola focal length precluded the use of pattern recognition techniques. This ambiquity between error sources introduces an uncertainty in the best fit focal length estimated from scanning data, which is equal to 0.42 times the uncertainty in horizontal positioning. In addition, the practical lower bounds for all three set-up tolerances are dependent on the resolution of the system detector. Analysis of worst case error combinations indicate the need for yet closer positioning and alignment tolerances. DOE

N79-11497# California Univ., Livermore. Lawrence Livermore Lab.
DESIGN GUIDE FOR SHALLOW SOLAR PONDS
A. B. Casamajor and R. E. Parsons 6 Jan. 1978 74 p refs
(Contract W-7405-eng-48)
(UCRL-52385) Avail: NTIS HC A04/MF A01

The Solar Energy Group at LLI developed shallow solar ponds to supply solar-heated water for industrial and commercial use at a cost that is competitive with conventional energy sources. Three aspects of the SSP technology are discussed: (1) an introduction to SSP technology, potential, and limitations; (2) a detailed description of the design and operation of an SSP system including component drawings and specifications; and (3) planning information so that an SSP system can be used for a particular application and the cost can be estimated. DOE

N79-11498# Fluor Engineers and Constructors, Inc., Irvine, Calif.
ECONOMICS OF TEXACO GASIFICATION: COMBINED CYCLE SYSTEMS. ECONOMIC STUDIES OF COAL GASIFICATION COMBINED CYCLE SYSTEMS FOR ELECTRIC POWER GENERATION
B. McElmurry and S. Smelser Apr. 1978 126 p
(EPRI-AF-753) Avail: NTIS HC A07/MF A01

Air blown coal gasification coupled with combined cycle power generation was investigated to determine whether an air blown gasifier had economic incentives greater than oxygen blown gasification. Gasification processes were integrated with combined cycle plants based on advanced gas turbine technology (2,400 F combustion outlet) estimated to be available in the 1981-1985 time period. The evaluations were based on complete grass-roots facilities sized to conform to the present electric utility practice of building units of approximately 1,000 MW capcity. Results show that the process with air blown gasification is economically equivalent to oxygen blow gasification. Also, development emphasis should be be placed on power generation, rotating machinery, heat transfer equipment, and further gasification pilot plant experiments to maximize the overall thermal efficiency of air blown gasification. Both processes have the potential for commercialization in the mid to late 1980's. DOE

N79-11499# Brookhaven National Lab., Upton, N. Y.
ANNUAL HIGHLIGHTS OF THE ENERGY TECHNOLOGY PROGRAMS
Dec. 1977 31 p
(Contract EY-76-C-02-0016)
(BNL-50799) Avail: NTIS HC A03/MF A01

The objective, scope, significant accomplishments in 1977, principal activities planned for 1978, and publications are presented for each program. The energy storage and conversion division programs are in two broad areas: electrolysis-based hydrogen energy storage systems and related technologies and conservation in buildings and community systems. The engineering division programs include work in solar energy, fossil energy, and combustion technology areas. The conservation program management group has responsibilities of national scope involving R and D projects carried out in coordination with industry and universities. DOE

N79-11500# Brookhaven National Lab., Upton, N. Y.
ENERGY NEEDS, USES, AND RESOURCES IN DEVELOPING COUNTRIES
P. F. Palmedo, R. Nathans, E. Beardsworth, and S. Hale, Jr. Mar. 1978 158 p refs
(Contract EY-76-C-02-0016)
(BNL-50784) Avail: NTIS HC A08/MF A01

If traditional patterns of development are to continue, oil consumption in the non-OPEC LDCs will grow steadily to become comparable with current U.S. consumption between 2000 and 2020. In the absence of major actions to replace noncommercial fuels or to increase the effectiveness with which they are used, a large fraction of the 3 to 4 billion LDC rural population in the year 2000 will not be able to raise their energy usage above subsistence levels. There is a variety of solutions to these problems, many of them emerging directly from the changed economics of energy. For example , most LDCs have not adequately explored and developed their own, indigenous resources; in virtually all energy conversion and utilization processes there are opportunities for improvements in efficiency and substitution of renewable energy forms. In virtually all these areas there are opportunities for effective assistance activities. DOE

N79-11501# ESB, Inc., Yardley, Pa. ESB Technology Center.
SODIUM-ANTIMONY TRICHLORIDE BATTERY DEVELOPMENT PROGRAM FOR LOAD LEVELING Interim Report
A. M. Chreitzberg Apr. 1978 143 p refs
(EPRI-EM-751) Avail: NTIS HC A07/MF A01

Cell tests on 2-, 20-, 55-, and 80-Wh cells provided data for the projection of performance for 200-Wh single-tube cells of 181 Wh/l and 88 Wh/kg at the 5-hour rate. Twenty-watt-hour cells deliver up to 500 100% depth cycles at 3 cycles per day. Ceramic processes--formerly magnesia-doped beta--were converted to lithia-doped beta with a reduction in specific resistivity and an increase in Na/Na test life to greater than 1500 Ah/cm2beta. A complete cost analysis is presented for beta tubes and an estimate for a 100-MWh load-leveling battery yields $39/kWh. Major concerns are the unpredictable life of

beta alumina solid electrolyte, positive current collector corrosion, short seal life, and the low probability of achieving load-leveling-battery cost targets. DOE

N79-11502# General Electric Co., Schenectady, N. Y. Corporate Research and Development Dept.
DEVELOPMENT OF SODIUM-SULFUR BATTERIES FOR UTILITY APPLICATION Interim Report
S. P. Mitoff and D. Chatterji May 1978 312 p
(EPRI-EM-683) Avail: NTIS HC A14/MF A01

Over 150 small (16-Ah) cells were placed on test. Lifetimes up to 12,000 hours and up to 1,150 Ah/cm2 were obtained. Cell capacities of over 80% were achieved and sustained for over 250 cycles. The most common failure mode involved degradation of the glass seal between the beta-alumina tube and the alpha-alumina header. Thermocompression bonding of steel containers to the alpha alumina insulator was chosen as the first choice for the exterior seals. The basic unit of the system is a module which is a thermally self-sufficient package. It consists of 360 cells (300 Wh each). The cells within the module are arranged in nine bundles in series, each bundle consisting of forty cells connected in parallel. Manufacturing cost studies were presented. A cost projection for a battery system of commercial size, 100 megawatt-hours is projected to be about $38/kWh. The effect of the ceramic electrolyte tube size on the system selling price was also investigated. A summary of supporting research activities was given. DOE

N79-11503# Department of Energy, Washington, D. C. Div. of Solar Applications.
SOLAR HEATING AND COOLING DEMONSTRATION PROJECT SUMMARIES
May 1978 270 p
(DOE/CS-0009) Avail: NTIS HC A12/MF A01

The design and operating characteristics of all commercial and federal residential solar heating and cooling systems and the structures themselves are described. Also included are available pictures of the buildings and simplified solar system diagrams. A list of non-federal residential installations is provided. DOE

N79-11504# Argonne National Lab., Ill. Components Technology Div.
VAPOR/LIQUID INTERACTION AND ENTRAINMENT IN SHELL-AND-TUBE EVAPORATORS
D. Yung, J. J. Lorenz, and E. N. Ganic Jun. 1978 32 p refs
(Contract W-31-109-eng-38)
(ANL-OTEC-78-2) Avail: NTIS HC A03/MF A01

The problem of vapor/liquid interaction and entrainment in shell-and-tube evaporators is analyzed. Attention is focused primarily on the horizontal tube falling film evaporators, which were proposed for use in Ocean Thermal Energy Conversion (OTEC) power plants. In the horizontal tube design, liquid falls from one tube to the next in either a droplet or column mode. A criterion is derived for predicting the transition from the droplet mode to the column mode. Models are developed for predicting the deflection of droplets and columns due to vapor crossflow. Based on an experimental study of drop detachment and breakup, a correlation is established for determining the resulting droplet sizes. For high vapor crossflow velocities, a criterion is presented for predicting the inception of liquid entrainment by a process known as stripping. Based on the foregoing models, conditions are defined under which vapor/liquid interaction and entrainment are important for OTEC evaporators. DOE

N79-11505# Sandia Labs., Albuquerque, N. Mex.
SANDIA LABORATORIES' MIDTEMPERATURE SOLAR SYSTEMS TEST FACILITY
R. M. Workhoven 1978 5 p refs Presented at Seminar on Testing Solar Energy Mater. and Systems, Wash., D. C., 22 May 1978
(Contract EY-76-C-04-0789)
(SAND-78-0940C; Conf-780550-2) Avail: NTIS HC A02/MF A01

It was established as a national test laboratory to develop technology that applies solar energy principles and to demonstrate the feasibility of the solar total energy concept. The system test facility was sized to meet the energy requirements of the Solar Projects Building. The building's electrical load is 32 kW for an 11-hr day or a daily total of 352 kWh. The cascaded energy from a turbine condenser (approximately 200 kW th) meets about 70% of the building's peak heating and cooling demand and is supplemented by conventional means on peak load days. The system is briefly described. DOE

N79-11506# Argonne National Lab., Ill.
BIOMIMETIC APPROACH TO SOLAR ENERGY CONVERSION: ARTIFICIAL PHOTOSYNTHESIS
J. J. Katz 1978 16 p refs Presented at 5th Energy Technol. Conf., Wash. D. C., 27 Feb. 1978
(Contract W-31-109-eng-38)
(CONF-780222-5) Avail: NTIS HC A02/MF A01

Results of efforts to devise apparatus and systems for using solar energy for chemical purposes by methods that mimic those used by photosynthetic organisms are reported. Sufficient progress has been made in the understanding of plant photosynthesis to make artificial photosynthesis a reasonable goal. Artificial photoreaction centers, the apparatus used by photosynthetic organisms for light energy conversion to chemical oxidizing and reducing capacity, have been made in the laboratory. The synthetic reaction centers mimic with remarkable fidelity the properties of their in vivo prototypes. Some of the formidable problems that must still be solved and the future prospects for biomimetic devices for solar energy conversion are discussed. DOE

N79-11507# Argonne National Lab., Ill.
STIBINE AND ARSINE GENERATION FROM A LEAD-ACID CELL DURING CHARGING MODES UNDER A UTILITY LOAD-LEVELING CYCLE
R. Varma and N. P. Yao Mar. 1978 44 p refs
(Contract W-31-109-eng-38)
(ANL/OEPM-77-5) Avail: NTIS HC A02/MF A01

An investigation was conducted to determine stibine and arsine generation during charging of a large industrial lead-acid cell (2250 Ah capacity at 5-h rate) under contemplated utility load-leveling duty cycles. The noxious gases generated were absorbed in a 3N H2SO4 solution containing KI and I2. The antimony and arsenic contents of the absorber solutions were determined by colorimetry and atomic absorption spectrophotometry, respectively. Total emissions of stibine and arsine, as well as their generation-rate profiles, were determined each week in experiments consisting of four charge cycles and one equalization charge. In addition, hydride generation during successive, daily equalization charges was monitored. Generation of stibine and arsine from the lead-acid cell was found to be significant during the overcharge period of a charge cycle and during equalization charging at 2.65 and 2.55 V. DOE

N79-11508# Argonne National Lab., Ill. Chemical Engineering Div.
ADVANCED SECONDARY BATTERIES FOR ELECTRIC VEHICLE PROPULSION
N. P. Yao 1978 20 p refs Presented at the Advan. Transit Assoc. Intern. Conf., Indianapolis, 25-28 Apr. 1978
(Contract W-31-109-eng-38)
(CONF-780426-2) Avail: NTIS HC A02/MF A01

Contemplated battery applications and requirements for electric vehicles are summarized. Development goals for the applications and the technological status of near-term state-of-the-art and long-term advanced batteries are reviewed. Among the near-term batteries for electric vehicles are the improved lead-acid, nickel-iron, and nickel-zinc systems. Zinc-chlorine, sodium-sulfur, and lithium-metal sulfide systems are the most promising advanced batteries under development. Batteries are modular in construction, nearly pollution-free in operation, and can be custom-tailored, in principle, to almost all power and energy levels, shapes, and environmental conditions. DOE

N79-11509# California Univ., Berkeley. Lawrence Berkeley Lab.
STUDY OF PHONON-INDUCED ENERGY TRANSFER PROCESSES IN CRYSTALS USING HEAT PULSES Ph.D. Thesis
A. R. Burns Mar. 1978 108 p refs
(Contract W-7405-eng-48)
(LBL-7631) Avail: NTIS HC A06/MF A01

The phonon-assisted delocalization of trapped excited triple

state energy in the aromatic crystal 1,2,4,5-tetrachlorobenzene (TCB) is studied by monitoring the time-resolved decrease in trap phosphorescence intensity due to the propagation of a well defined heat pulse. The excitation distribution in a single and a multiple trap system are discussed. A previously developed kinetic model is presented which relates the efficiency of trap-phonon coupling matrix elements. A bolometric technique for determining the thermal response time of the heater/crystal system is presented. The theory of heat pulse phonon spectroscopy is also presented and discussed in terms of black-body phonon radiation. DOE

N79-11510# Energy Research and Development Administration, Washington, D. C.
NEED FOR AND DEPLOYMENT OF INEXHAUSTIBLE ENERGY RESOURCE TECHNOLOGIES: REPORT OF TECHNOLOGY STUDY PANEL INEXHAUSTIBLE ENERGY RESOURCES STUDY
Sep. 1977 470 p refs
(TID-28202) Avail: NTIS HC A20/MF A01

The technical state-of-the-art, timing and cost barriers of the various inexhaustible technologies, and their relationships to the nation's needs are assessed. Principal summary observations and results are included. The eleven sections are entitled: executive summary; introduction; energy demand and exhaustible supply projections; exhaustible energy sources; inexhaustible energy resource technologies; impact of energy market place; engineering solution; results and recommendations; IERS technology study panel commentary; technology study panel fact sheets; and, energy production cost data and equations. DOE

N79-11511# Oak Ridge National Lab., Tenn.
ENERGY AVAILABILITIES FOR STATE AND LOCAL DEVELOPMENT: PROJECTED ENERGY PATTERNS FOR 1980 AND 1985
D. P. Vogt, P. L. Rice, and V. P. Pai Jun. 1978 536 p refs
Sponsored in part by Dept. of Commerce
(Contract W-7405-eng-26)
(ORNL/TM-5890/54) Avail: NTIS HC A23/MF A01

Projections of the supply, demand and net imports of seven fuel types and four final consuming sectors for the nation for 1980 and 1985 are presented. The data are formatted to present regional energy availability from primary extraction, as well as from regional transformation processes. The tables depict energy balances between availability and use for each of the specific fuels. A consistent base of historic and projected energy information within a standard format is provided. It should aid regional policymakers in their consideration of regional growth issues that may be influenced by the regional energy system. This basic data must be supplemented by region-specific information which only the local policy analyst can bring to bear in his assessment of the energy conditions which characterize each region. DOE

N79-11512# Recon Systems, Inc., Princeton, N. J.
FUNDAMENTAL DATA NEEDS FOR COAL CONVERSION TECHNOLOGY APPENDICES
7 Oct. 1977 437 p refs
(Contract EY-76-C-02-4059)
(TID-28152-App) Avail: NTIS HC A19/MF A01

Eleven coal conversion processes including major liquefaction and gasification processes were studied. Emphasis was placed on thermodynamic data. Analysis of the conversion processes, including contact with developers and designers, resulted in compilations of data needs in the following categories: physical properties, thermodynamic properties, chemical properties, transport properties, and engineering data. Temperature and pressure ranges are specified for each of the data needs. DOE

N79-11513# Canterbury Univ., Christchurch (New Zealand).
ENERGY ANALYSIS
R. G. Pearson Dec. 1977 17 p refs Prepared in cooperation with Lincoln Coll., Canterbury, New Zealand
(NP-23145; Rept-30; ISSN-0110-1692) Avail: NTIS (US Sales Only) HC A02/MF A01 DOE Depository Librarie

A discipline called Energy Analysis (EA) formalizes the calculation of the energy requirements of any product or process. These requirements include not only the fuel and electricity consumed directly by the particular process in question, but also the fuel and power used indirectly to produce the goods and services associated with the process. Thus, the energy requirements of a kilogram of potatoes includes the fuel and power used on the farm, in trucks and by green grocers, and also that used to make the fertilizer, the tractors, the trucks, and so on. The development of EA is described and its potential applications in New Zealand are examined by evaluating the arguments for and against its adoption. DOE

N79-11514# Michigan Technological Univ., Houghton.
ENERGY AND PROTEIN PRODUCTION FROM PULP MILL WASTES Progress Report, 15 Dec. 1977 - 15 Mar. 1978
M. F. Jurgensen and J. T. Patton 15 Mar. 1978 9 p
(Contracts EY-76-S-02-2983; E(11-1)-2983)
(COO-2983-7) Avail: NTIS HC A02/MF A01

The increasing of yeast protein production using ozonated spent sulfite liquor (SSL) and the improving of biodegradability of SSL by ultrasonic treatments are described. Continuous-flow fermentation experiments demonstrated the suitability of ozonate SSL as a substrate for Torula yeast growth. Yeast yields averaging between 2.0-2.2 g/l of SSL were obtained at the optimum retention time of 1.8 days. This contrasts to yeast production rates of 4.8-5.0 g/l of SSL in two day batch cultures. Effluent from anaerobic digestors used for methane production supported very little yeast growth even though it contains appreciable amounts of acetate. A toxic product or products apparently are synthesized during fermentation which are inhibitory to the Torula yeast. Experiments were also run to determine if sonic treatments would increase the content of fermentable substrates in SSL. Results indicated striking increases in BOD levels of SSL after sonication, especially when used in conjunction with ozonation. DOE

N79-11515# California Univ., Berkeley. Lawrence Berkeley Lab. Energy and Environment Div.
NATIONAL GEOTHERMAL INFORMATION RESOURCE Annual Report, 1977
S. L. Phillips 19 Apr. 1978 72 p refs
(Contract W-7405-eng-48)
(LBL-7803) Avail: NTIS HC A04/MF A01

Critically evaluated data and other information for the development and utilization of geothermal energy are represented. Included are both site dependent and site independent information related to resource evaluation, electrical and direct utilization, environmental aspects, and the basic properties of aqueous electrolytes. The information is organized into four principal areas: (1) basic geothermal energy data; (2) site-dependent data for both electrical and direct utilization; (3) environmental aspects and (4) data handling development. DOE

N79-11516# Sandia Labs., Albuquerque, N. Mex.
STRUCTURAL PERFORMANCE OF THE DOE/SANDIA 17 METER VERTICAL AXIS WIND TURBINE
W. N. Sullivan 1978 7 p refs Presented at the 23rd Natl. SAMPE Symp., Anaheim, Calif., 2 May 1978
(Contract EY-76-C-04-0789)
(SAND-78-0880C; Conf-780502-7) Avail: NTIS HC A02/MF A01

The structural performance of the 17 meter turbine blades was satisfactory during the two-blade test series. The strut, because of the high steady stresses from centrifugal loads, is the highest stressed structural member on the blade. Fatigue life consumption begins in the strut for wind speeds above 40 MPH. Considering the frequency of such winds at typical sites, the annual fatigue life consumption is still very small, on the order of 2%. DOE

N79-11517# Sandia Labs., Albuquerque, N. Mex.
DATA ACQUISITION AND SIGNAL PROCESSING FOR A VERTICAL AXIS WIND ENERGY CONVERSION SYSTEM
B. Stiefeld and R. N. Tomlinson 1978 8 p refs Presented at the Seminar on Testing Solar Energy Mater. and Systems, Washington, D. C., 22 May 1978
(Contract EY-76-C-04-0789)
(SAND-78-1000C; Conf-780550-4) Avail: NTIS HC A02/MF A01

The data acquisition and analyses system developed to meet

the needs of the 17 meter VAWT is described. The system employs a minicomputer-based data acquisition system with special peripheral equipment. Statistical methods described are employed to evaluate the performance of the system from both a structural and performance viewpoint. DOE

N79-11518# Delaware Univ., Newark. Coll. of Engineering.
HEAT STORAGE MATERIALS Final Report
C. E. Birchenall Dec. 1977 99 p refs
(Contracts EY-76-S-02-4042; E(11-1)-4042)
(COO-4042-16) Avail: NTIS HC A05/MF A01

The properties of various alloys, eutectics, and salts in respect to their usefulness for latent and sensible heat storage are surveyed and reported. DOE

N79-11519# Sandia Labs., Albuquerque, N. Mex.
THERMAL BATTERY REACTION PRODUCTS
P. F. Hlava 1978 4 p refs Presented at the 13th Conf. of the Microbeam Analysis Soc., Ann Arbor, Mich., 19 Jun. 1978
(Contract EY-76-C-04-0789)
(SAND-78-0185C; Conf-780616-2) Avail: NTIS HC A02/MF A01

Chemical reactions taking place during the discharge of a thermal battery were studied by the electron microprobe technique. All important elements in the system were determined, and a set of elemental distribution photomicrographs (EDPMs) was obtained. Several problems encountered during quantitative correction procedures are discussed. Discharged cells develop a complicated sequence of layers within the DEB pellet. The EDPMs of the cell show quite clearly that the materials are those expected. DOE

N79-11520# Sandia Labs., Albuquerque, N. Mex.
ZERO-BIAS RESISTANCE OF GRAIN BOUNDARIES IN NEUTRON TRANSMUTATION DOPED POLYCRYSTALLINE SILICON
C. H. Seager and T. G. Castner 1978 39 p refs Presented at IEEE Photovoltaic Spec. Conf., Wash., D. C., 5 Jun. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1159C; Conf-780619-9) Avail: NTIS HC A03/MF A01

At moderate to weak doping levels the resistivity of polycrystalline silicon is controlled by grain boundary potential barriers. Electrical transport behavior of bulk samples of this material as well as the resistance of individual grain boundaries were characterized. A model for grain boundary barrier formation was developed and compared to this data. The results indicate that a variety of grain boundary defect state densities exist in the neutron transmutation doped silicon samples. In the more highly doped samples this leads to a variety of barrier heights, inhomogeneous current distributions, and a decidedly non-Arrhenius temperature dependence of the bulk resistivity. Comparison of these results with thin film polycrystalline silicon data indicates that the electronic properties of the barriers in these films may well be dominated by impurities in the grain boundaries. The study is directed toward improving the efficiency of polycrystalline solar cells. DOE

N79-11521# Varian Associates, Palo Alto, Calif.
HIGH PERFORMANCE GaAs PHOTOVOLTAIC CELLS FOR CONCENTRATOR APPLICATIONS Final Report, 13 Oct. 1976 - 13 Oct. 1977
L. W. James, H. A. Vanderplas, and R. L. Moon Dec. 1977 87 p refs
(Contract EY-76-C-04-0789)
(SAND-78-7018) Avail: NTIS HC A05/MF A01

The AlGaAs/GaAs cell went from a workable design to an optimized design, and cell construction procedures advanced to the point where the predicted optimized efficiency, 23% AM 2 of 1000 suns, was obtained for a number of cells. The yield of cells exceeding some minimum efficiency increased steadily, with one temporary setback due to an uncontrolled thermal alloying cycle. The experimental results for best cells agree quite well with predicted efficiency vs air mass, concentration, and temperature. As a result of the work done, the AlGaAs/GaAs concentrator cell is ready for pilot-line production using some degree of automation, and incorporation into application experiments. DOE

N79-11522# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN (EDP): SOLAR THERMAL POWER SYSTEMS, 1977
Mar. 1978 61 p refs
(DOE/EDP-0004) Avail: NTIS HC A04/MF A01

The plan (EDP) briefly describes the goals of the program, and identifies potential environmental, health, safety, and socioeconomic impacts relevant to solar thermal power systems, particularly those sited in the southwest. These impacts are screened for key issues, i.e., those which are considered to be most serious in nature, which have near-term importance to the program, and for which current knowledge of effects and control is inadequate. A management plan is then presented for conducting and coordinating environmental research in concert with the technology development effort. This will ensure that identified environmental issues are resolved prior to significant public deployment of the technology. Seven key issues related to solar thermal power systems are identified in this EDP: handling and disposal of system fluids and wastes, potable water contamination, heliostat reflection, ecological impacts of the heliostat field, alteration of the microclimate, land use, and utility-consumer interface. DOE

N79-11523# Ocean Data Systems, Inc., Monterey, Calif.
OTEC THERMAL RESOURCE REPORT FOR FLORIDA EAST COAST
Oct. 1977 61 p refs
(Contract EG-77-C-01-4028)
(TID-27948) Avail: NTIS HC A04/MF A01

Most probable monthly temperature profiles from surface to 1500-meter depths were developed for eight one-degree latitude-longitude squares off the East Coast of Florida for Ocean Thermal Energy Conversion (OTEC) purposes. These fairly shallow ocean areas are characterized by large time and space variability of temperature at all depths. In particular, a temperature differential (delta T) varies considerably annually and within any month. There may be smaller areas with consistent delta T values, but they were not apparent from this analysis based on one-degree squares. An inventory summary of the temperature observations available in the area, as well as overall bathymetric information are presented. The monthly temperature data are provided in tabular form and as plots of delta T versus depth for each latitude-longitude square. A separate annex to this report contains detailed bathymetry, complete data inventories, locator plots of all observations and results of intermediate analysis. DOE

N79-11524# Carrier Corp., Syracuse, N. Y. Energy Systems Div.
CANDIDATE CHEMICAL SYSTEMS FOR AIR COOLED, SOLAR POWERED, ABSORPTION AIR CONDITIONER DESIGN. PART 1: ORGANIC ABSORBENT SYSTEMS
W. J. Biermann [1977] 126 p
(Contract EG-77-C-03-1587)
(SAN-1587-1) Avail: NTIS HC A07/MF A01

All the available experimental evidence suggests that the optimum organic absorbent/refrigerant combination would be a methane derivative with a single hydrogen atom with chlorine and fluorine atoms in the other sites, as refrigerant. This would be hydrogen bonded to an absorbent molecule containing the group = NC-O, with the substituent groups being such that no steric hindrance took place. Cycle analyses showed that the ratio of internal heat transfer to cooling would be large, probably impractically so in view of the high coefficient of performance needed for solar driven cooling and the additional handicap of heat rejection to the atmosphere. A more promising approach would be to reduce the internal heat transfer per unit of space cooling by selecting a refrigerant with a high latent heat of vaporization and selecting an absorbent with suitable properties. DOE

N79-11525# Sandia Labs., Albuquerque, N. Mex.
SOLAR IRRIGATION PROGRAM PLAN: SECOND REVISION
R. L. Alvis and L. L. Lukens May 1978 28 p refs Revised
(Contract EY-76-C-04-0789)
(SAND-78-0308-Rev) Avail: NTIS HC A03/MF A01

Program goals are listed, participants named, and their responsibilities outlined. Program efforts are divided into the

following: design analysis and system experimentation; system application analysis; and market definitions and analysis. A deep-well experiment, the Gila-Bend experiment, and a shallow-wall experiment are analyzed. Irrigation experiments are planned and their analyses are described. DOE

N79-11526# General Atomic Co., San Diego, Calif.
FIXED MIRROR SOLAR CONCENTRATOR FOR POWER GENERATION
J. R. Schuster, J. L. Russell, Jr., G. H. Eggers, and S. V. Shelton Mar. 1978 25 p Presented at Symp. on Solar-Thermal Power Stations, Cologne (Germany), 12 Apr. 1978
(Contract EY-76-C-04-0789)
(GA-A-14883; Conf-780425-3) Avail: NTIS HC A02/MF A01

The concentrator employs a fixed mirror trough that produces a sharp line focus regardless of sun position. The heat receiver, which employs a compound parabolic secondary concentrator, is moved in a circular arc to track the focal line. With secondary concentration, a theoretical upper concentration limit of 206 suns, is possible. The secondary concentrator makes possible the design of a practical concentrator to efficiently generate steam at modern steam plant operating conditions. Because the mirror trough is stationary, it can be made using low-cost type construction approaches. Modules of precast concrete and glass mirrors were fabricated to supply a collector field to Sandia Laboratories for their Solar Total Energy Demonstration Facility. These modules were constructed on-site at Sandia using local labor. The combination of concrete substrate and glass mirrors yields a rugged, low-maintenence concentrator that has good potential for low-cost, high volume, on-site construction. Another construction approach based on supporting the glass mirrors with inexpensive metal stamping has also been developed. These structures can be quickly assembled in the field. S.B.S.

N79-11527# Sandia Labs., Albuquerque, N. Mex.
EFFECT OF SOLAR CELL PARAMETER VARIATION ON ARRAY POWER OUTPUT
J. L. Watkins and E. L. Burgess 1978 6 p refs Presented at IEEE Photovoltaic Specialists Conf., Washington, D.C., 5 Jun. 1978
(Contract EY-76-C-04-0789)
(SAND-78-0917C; Conf-780619-7) Avail: NTIS HC A02/MF A01

Variations in cell series resistance, cell photon generated current, and cell temperature were considered independent and the effect of their variation on array performance was investigated using a combination of analysis techniques and a computer circuit simulation program, SPICE. Results indicate that for series connected arrays, variations around a mean of cell series resistance and cell operating temperature insignificantly affect array maximum power. However, variations in cell photon generated current significantly affects power output as array current is limited by the weakest cell. Universal curves are presented which allow these results to be applied to a variety of arrays. DOE

N79-11528# Brookhaven National Lab., Upton, N. Y. Policy Analysis Div.
ENERGY SITUATION IN THE MID-ATLANTIC REGION
James S. Munson and Joel P. Brainard Aug. 1977 263 p refs
(Contract EY-76-C-02-0016)
(BNL-50703) Avail: NTIS HC A12/MF A01

The patterns of energy production, supply and demand are described by the state. These patterns are compared to national and regional averages. A picture of existing energy and environmental interactions and a view of potential energy and environmental conflicts are presented. The major issues are reviewed by energy sector as a description of the existing energy actors and major energy programs for Ohio, West Virginia, Virginia, Pennsylvania, New Jersey, New York, Delaware, Maryland, Puerto Rico, Virgin Islands, and Washington, D.C. DOE

N79-11529# Sandia Labs., Albuquerque, N. Mex.
DEVELOPMENT OF HIGH-EFFICIENCY P(+)-N-N(+) BACK-SURFACE-FIELD SILICON SOLAR CELLS
J. G. Fossum, R. D. Nasby, and E. L. Burgess 1978 6 p refs Presented at the IEEE Photovoltaic Specialists Conf., Washington, D.C., 5 Jun. 1978
(Contract EY-76-C-04-0789)
(SAND-78-1156C; Conf-780619-2) Avail: NTIS HC A02/MF A01

Primary physical mechanisms that can limit solar cell performance were identified and characterized by an analytical study. From the study results, near optimum back-surface-field solar cells were designed and fabricated. Power-conversion efficiencies of nearly 17% at AM1 and greater than 18% at illuminations near 50 suns have been measured at 27 C. The cell fabrication process is straightforward and is characterized by exceptionally high yield. DOE

N79-11530# Sandia Labs., Albuquerque, N. Mex.
THERMAL BATTERY REACTION PRODUCTS: CHARACTERIZATION BY ELECTRON MICROPROBE X-RAY ANALYZER AND TRANSMISSION ELECTRON MICROSCOPE
P. F. Hlava and T. J. Headley Oct. 1977 33 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1317) Avail: NTIS HC A03/MF A01

A series of DEB-type thermal battery cells which had experienced various stages of discharge was prepared and analyzed with the electron microprobe and transmission electron microscope to determine the compositions, crystal structures, and distribution of the phases present in the reaction products. A series of six layers was found in the DEB pellet after discharge. DOE

N79-11531# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN (EDP): OCEAN THERMAL ENERGY CONVERSION, 1977
Mar. 1978 48 p refs
(DOE/EDP-0006) Avail: NTIS HC A03/MF A01

The status and goals of the OTEC program are described. Potential environmental, health, safety, and socioeconomic impacts relevant to OTEC are identified. These impacts are screened for key issues, i.e., those which are considered to be most serious in nature, which have near-term importance to the program, and for which current knowledge of effects and control strategies is inadequate. A management plan is presented for conducting and coordinating environmental research in concert with the technology development effort. This will ensure that identified environmental issues are resolved prior to significant public utilization of OTEC systems. The nine key issues associated with OTEC deployment are: ocean water mixing; metallic discharges; impingement/entrainment; use of biocides; working fluid leaks; climatological impacts; worker safety; international law; and secondary impacts. DOE

N79-11532# Lockheed Missiles and Space Co., Sunnyvale, Calif.
OCEAN THERMAL ENERGY CONVERSION (OTEC) DEVELOPMENT OF AN APPARATUS TO MEASURE BIOFOULING EFFECTS ON HEAT EXCHANGERS IN OCEAN ENVIRONMENTS
Oct. 1977 143 p
(Contract EY-76-C-06-1830)
(LMSC-D-562046) Avail: NTIS HC A07/MF A01

The design, calibration and operation of the test device are described. Drawings are included. The system incorporates thermoelectric modules to provide the heat flux and thermistors for temperature monitoring. The apparatus is designed for use in: (1) establishing the severity of the biofouling problem and its effect on heat transfer under OTEC operating conditions, (2)measuring the effectiveness of potential countermeasures, and (3) obtaining accurate heat transfer data that will be used in the design of OTEC heat exchangers. DOE

N79-11533# Waterloo Univ. (Ontario).
METHODS FOR REDUCING HEAT LOSSES FROM FLAT PLATE SOLAR COLLECTORS, PHASE 2 Final Report, 1 Feb. 1976 - 31 Aug. 1977
K. G. T. Hollands, G. D. Raithby, and T. E. Unny Mar. 1978 84 p refs
(Grant EY-76-G-02-2597)
(COO-2597-4) Avail: NTIS HC A05/MF A01

Improvements to flat plate solar collectors for heating and cooling of buildings were investigated through two parallel studies. The first study, which deals with the free convective heat loss from V-corrugated absorber plate to a plane glass cover, shows that for the same average spacing, the free convective heat

loss is greater for a V-corrugated absorber plate than for a plane absorber plate. However, provided the average spacing is large enough, the amount of increase is slight. The second study, which deals with the free convective heat loss in a honeycomb solar collector in which the honeycomb consists of a set of horizontal partitions, or slits, shows that provided the solar collector is tilted to near vertical, such a honeycomb gives equivalent or superior free convective loss suppression than does a square-celled honeycomb having the same amount of material. Correlation equations for the free convective heat loss are given for both studies. DOE

N79-11534# California Univ., Berkeley. Lawrence Berkeley Lab.

DEFINITION OF ENGINEERING DEVELOPMENT AND RESEARCH PROBLEMS RELATING TO THE USE OF GEOTHERMAL FLUIDS FOR ELECTRIC POWER GENERATION AND NONELECTRIC HEATING

J. A. Apps Nov. 1977 63 p refs
(Contract W-7405-eng-48)
(LBL-7025) Avail: NTIS HC A04/MF A01

The use of geothermal fluids for electric power generation and nonelectric purposes causes problems not normally encountered when pure water is used for similar purposes. These problems must be identified and means developed to overcome them before geothermal energy resources can become an important source of electric power or thermal energy in the United States. Research and development projects aimed at solving problems arising from the use of geothermal fluids from known sources in the United States are listed. Problem areas covered are: impact on engineering design caused by chemical, thermodynamic, and transport properties of geothermal fluids; scaling and sludge formation; gases, volatile brine constituents, condensate chemistry; and environmental problems. The research projects identified are general in nature and are not site specific. DOE

N79-11535# General Electric Co., Philadelphia, Pa. Space Div.

APPLIED RESEARCH ON ENERGY STORAGE AND CONVERSION FOR PHOTOVOLTAIC AND WIND ENERGY SYSTEMS. VOLUME 3: WIND CONVERSION SYSTEMS WITH ENERGY STORAGE Final Report

Jan. 1978 330 p refs Sponsored in part by DOE
(Contract NSF C-75-22221-01)
(HCP/T22221-01/3) Avail: NTIS HC A15/MF A01

Energy storage technologies deemed best suited for use in conjunction with a wind energy conversion system in utility, residential and intermediate applications were evaluated. Break-even cost goals are presented for several storage technologies in each application. These break-even costs are compared with cost projections to show technologies and time frames of potential economic viability. Results, conclusions and recommendations pertaining to use of energy storage with wind energy conversion systems are included. DOE

N79-11536# California Univ., Livermore. Lawrence Livermore Lab.

EVALUATED PHYSICAL PROPERTIES DATA FOR MATERIALS USED IN ENERGY STORAGE SYSTEMS

V. E. Hampel and L. H. Gevantman (NBS, Washington, D.C.) May 1978 25 p Presented at the 6th Intern. CODATA Conf., Palermo, Italy, 22-25 May 1978
(Contract W-7405-eng-48)
(UCRL-81159; Conf-780587-1) Avail: NTIS HC A02/MF A01

The Lawrence Livermore Laboratory under contract to the Division of Energy Storage Systems of the U.S. Department of Energy (DOE/STOR), identifies materials and properties required for batteries, flywheels, and for thermal or chemical systems. The users of these data set the priorities for evaluation. Requests are forwarded to the Office of Standard Reference Data of the National Bureau of Standards (NBS/OSRD) which selects and engages other sources of expertise. In addition, OSRD manages and monitors the output of data evaluations prior to their being published as part of the NSRD/NBS series, and prior to their being stored on a PDP-11/70 mini-computer for subsequent assess through the Integrated Information System at LLL. Administrators of DOE/STOR, researchers, engineers and DOE contractors can thus assess the physical properties in a selective, concise, and up-to-date manner on demand over the ARPAnet and by telephone dial-up from remote terminals nationwide.DOE

N79-11537# Sandia Labs., Livermore, Calif.

SPECIFIC HEAT VARIATIONS IN OIL ENERGY STORAGE MEDIA AND THEIR ECONOMIC IMPLICATIONS

R. W. Carling and L. G. Radosevich Jun. 1978 25 p refs
(Contract EY-76-C-04-0789)
(SAND-78-8672) Avail: NTIS HC A02/MF A01

Hydrocarbon oils were investigated for use as thermal energy storage media in solar thermal electric systems. In systems storing the energy as sensible heat, the energy storage capacity is determined by the specific heat of the oil. Among the oils studied is Caloria HT-43. Previously reported specific heat data on Caloria HT-43 show values differing by as much as 25 percent. An attempt was made to resolve this discrepancy by measuring the specific heat from 77 to 327 C. Results show values from four samples varying by as much as 11 percent. The variations are correlated with differences in average molecular weights and inhomogeneity of the samples. The impact on cost of an 11 percent variation in specific heat is less than 1 percent for oil/rock systems and less than 2 percent for an all-oil system. DOE

N79-11538# California Univ., Livermore. Lawrence Livermore Lab.

MECHANICALLY RECHARGEABLE, METAL-AIR BATTERIES FOR AUTOMOTIVE PROPULSION

John F. Cooper and E. L. Littauer 26 May 1978 8 p refs Presented at the 13th Intersoc. Energy Conversion Eng. Conf., San Diego, Calif., 20-25 Aug. 1978 Prepared in cooperation with Lockheed Missiles and Space Co., Palo Alto, Calif.
(Contract W-7405-eng-48)
(UCRL-81178; Conf-780801-8) Avail: NTIS HC A02/MF A01

The batteries are refueled by the addition of anode plates and water, while the reaction product is withdrawn to be recycled at fixed industrial sites. Aluminum is most attractive for this application because of the large domestic industry expected in the 1980's. Battery performance is projected from reported cell data for a hardware designed for rapid addition of electrodes. The reaction product is processed in the battery to form a purified, dry powder of trihydrated alumina-a feedstock of the current aluminum industry. For a 30 kW peak battery weighing 220 to 250 kg, ranges of 500 to 750 km are estimated for a one-ton vehicle. Costs of recycled aluminum and air-cathode modules comprise 85 percent of the total cost (ca 5 cents/km) of battery ownership and operation. DOE

N79-11539# Stanford Univ., Calif. Inst. for Energy Studies.

ENERGY AND THE ECONOMY Final Report

William W. Hogan Jan. 1978 40 p refs
(EPRI-EA-620-Vol-1) Avail: NTIS HC A03/MF A01

Six models of energy and the economy were compared. The comparison illuminates the structure of the models and identifies the importance of a few key elements in determining the nature of the feedback from the energy sector to the remainder of the economy; the value share of energy, the potential for the substitution of capital and labor for energy, and the interaction between energy availability and capital formation. The strengths and weaknesses of the models in application to the study of energy and the economy are discussed, with emphasis on the contribution to improved communication between decision makers and energy modelers. DOE

N79-11540# California Univ., Berkeley. Lawrence Berkeley Lab.

URBANISM AND ENERGY IN DEVELOPING REGIONS

Richard L. Meier, S. Berman, and D. Dowell 1 Mar. 1978 100 p refs
(Contract W-7405-eng-48)
(LBL-7808) Avail: NTIS HC A05/MF A01

Population growth assessments for Sao Paulo-Rio de Janeiro, Calcutta, Cairo-Alexandria, Mexico City, and Seoul are presented. This analysis-from-a-distance is insufficient to judge how much extra installed electrical generating capacity is required before 1995, the added refining capability for liquid fuels, or the uses for new LNG and coal imports due to be arranged. Results

indicate that energy (and perhaps also water in most regions) planning is the major determinant of the manner in which these urban areas will adapt to the extraordinary pressures for new settlement. Energy supplies must be planned to meet requirements set by locally dominant values regarding human services and the environment. DOE

N79-11541# Argonne National Lab., Ill.
INTEGRATING TECHNOLOGIES TO PRODUCE ENERGY CONSERVATION
Robert E. Holtz and Thomas J. Marciniak 1978 19 p refs Presented at the 2d Natl. Conf. and Exhibition on Technol. for Energy Conservation, Albuquerque, N. Mex., 24-27 Jan. 1978
(Contract W-31-109-eng-38)
(CONF-780109-6) Avail: NTIS HC A02/MF A01

Urban energy systems are essentially designed to meet the electrical, heating, cooling, and miscellaneous energy demands of the community they serve. This paper briefly reviews each of the more prominent of the past, present, and perhaps the future technologies. The systems are discussed in the order of the time frame of their commercial availability. An analysis of a fuel cell based system, a heat pump centered system, and a Diesel engine based system is also presented. The addition of a pyrolysis unit which employs the refuse from the site, with the Diesel engine based system, is also examined. DOE

N79-11542# Department of Energy, Washington, D. C. Div. of Consumption Data Studies.
FEDERAL ENERGY DATA SYSTEM (FEDS) TECHNICAL DOCUMENTATION
Raymond F. Fuller Jun. 1978 117 p refs
(PB-281815/1; DOE/EIA-0031/1; CRN-780301-00087) Avail: NTIS HC A06/MF A01 CSCL 10A

Data system areas covered are: (1) an explicit definition of each data series including source, methodology, naming conventions, and idiosyncrasies which do not follow directly from the published source; (2) table of contents and description for the on-line FEDS; (3) an explicit detailed description of the FEDS computer tape; (4) completed summary of conversion factors and scalers; (5) glossary of energy terms. GRA

N79-11543# National Bureau of Standards, Washington, D. C.
PLAN FOR THE DEVELOPMENT AND IMPLEMENTATION OF STANDARDS FOR SOLAR HEATING AND COOLING APPLICATIONS
D. Waksman, J. H. Pielert, R. D. Dikkers, E. R. Streed, and W. J. Niessing Jun. 1978 58 p refs Supersedes NBSIR-76-1143
(Contract EA-77-A-1-6010)
(PB-283237/6; NBSIR-78-1143A; NBSIR-76-1143) Avail: NTIS HC A04/MF A01 CSCL 13A

Overviews of the building regulatory system in the United States are given along with a listing of the various standards which will be required for the various solar systems, subsystems, components and materials. A list of training activities and manuals of accepted practice is presented. The development of standards for solar applications by the Federal Government is outlined, as well as the potential interface and utilization of the existing consensus standards generating organizations. GRA

N79-11544# National Bureau of Standards, Washington, D. C. Center for Building Technology.
INTERNATIONAL PROJECT CATALOG OF MODULAR INTEGRATED UTILITY SYSTEMS
M. H. Nimmo and C. W. Phillips Jul. 1978 458 p
(PB-283477/8; NBS-SP-515; LC-78-600056) Avail: NTIS HC A20/MF A01 CSCL 13A

Project descriptions on more than 200 modular integrated utility systems type projects being conducted in the participating countries are presented. Each summary form includes a description of the project, its status, the approach, expected results, some technical data, the principal investigator, an indication whether or not data is/or will be available, and other miscellaneous project information. GRA

N79-11545# American Bar Foundation, Chicago, Ill.
OVERCOMING LEGAL UNCERTAINTIES ABOUT USE OF SOLAR ENERGY SYSTEMS
William A. Thomas, A. S. Miller, and R. L. Robbins (Lake Michigan Federation, Chicago) 1978 90 p
(Grant NSF APR-74-21034; NSF APR-76-18496)
(PB-283250/9; ISBN-910058-89-X; NSF/RA-780029) Copyright. Avail: NTIS HC A05/MF A01 CSCL 10A

In 1974 the American Bar Foundation initiated an assessment of legal issues related to the use of solar energy systems for heating and cooling. The relevant legal issues considered include the regulation of building materials, financing and marketing arrangements, the role of public utilities, land-use planning, and access to sunlight. GRA

N79-11546# General Accounting Office, Washington, D. C. Energy and Minerals Div.
THE FEDERAL GOVERNMENT SHOULD ESTABLISH AND MEET ENERGY CONSERVATION GOALS Report to Congress
30 Jun. 1978 121 p
(PB-283066/9; EMD-78-38) Avail: NTIS HC A06/MF A01 CSCL 10A

The following policies are evaluated: (1) energy conservation activity in the Nation, (2) Federal energy conservation programs directed at the private sector, (3) opportunities to achieve greater energy conservation, and (4) additional actions which could be taken by the Congress and the Department of Energy. GRA

N79-11547# Bureau of Mines, Washington, D. C.
PROJECTS TO EXPAND ENERGY SOURCES IN THE WESTERN STATES
Charles H. Rich, Jr. 1978 210 p
(PB-283706/0; BM-IC-8772) Avail: NTIS HC A10/MF A01 CSCL 10A

A survey was made of 808 fuel-related facilities ranging from coal and uranium mines and electric powerplants to storage and transportation projects, planned, proposed or under construction in all states west of the Mississippi River. It covers new construction, as well as expansion of existing coal mines, electric powerplants, coal conversion, and waste-to-fuel plants, oil shale projects, tar sands projects, geothermal facilities, coal slurry, petroleum, and natural gas pipelines, railroads needed for fuels development, terminal facilities, uranium mines, mills, and enrichment facilities, oil refineries, and natural gas processing plants and storage facilities. Projects are listed by category and by state, and the probable location of each is plotted on state maps. GRA

N79-11548# Office of Technology Assessment, Washington, D. C.
APPLICATION OF SOLAR TECHNOLOGY TO TODAY'S ENERGY NEEDS, VOLUME 1
Jun. 1978 522 p
(PB-283770/6; OTA-E-66-Vol-1) Avail: NTIS HC A22/MF A01 CSCL 10A

A range of solar energy systems designed to produce thermal and electrical energy directly from sunlight with units small enough to be located on or near the buildings they are designed to serve are reviewed. The state-of-the-art technology, the circumstances under which such systems could be economically attractive, and the problems encountered in integrating these devices into existing energy generation and delivery systems are examined. The impact that widespread use of decentralized solar energy equipment could have on the United States is assessed. GRA

N79-11549# National Bureau of Standards, Washington, D. C. Center for Mechanical Engineering and Process Technology.
COMMITTEE ON THE CHALLENGES OF MODERN SOCIETY RATIONAL USE OF ENERGY PILOT STUDY MODULAR INTEGRATED UTILITY SYSTEMS PROJECT. VOLUME 1: DESCRIPTION, ACTIVITIES, AND PRODUCTS Final Report
M. H. Nimmo and C. W. Phillips 1978 105 p Sponsored in part by HUD
(PB-283428/1; NBSIR-78-1-1468-1; NATO/CCMS-74/1) Avail: NTIS HC A06/MF A01 CSCL 13A

The project, its objectives, chronology, activities, and products are described. Copies of its products, and minutes of its meetings,

are included. The progress of each activity and product is discussed. GRA

N79-11550# National Technical Information Service, Springfield, Va.

DESIGN AND APPLICATIONS OF FLYWHEELS. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Aug. 1978

Guy E. Habercom, Jr. Sep. 1978 263 p Supersedes NTIS/PS-77/0882; NTIS/PS-76/0767; NTIS/PS-75/743; NTIS/PS-75/070

(NTIS/PS-78/0997/3; NTIS/PS-77/0882; NTIS/PS-76/0767; NTIS/PS-75/743; NTIS/PS-75/070) Avail: NTIS HC $28.00/MF $28.00 CSCL 13I

The design and varied applications of flywheels and reaction wheels are investigated. Such diversified applications as satellite stabilization, surface vehicle propulsion, energy transfer devices, and inertial or friction welding are reviewed. This updated bibliography contains 258 abstracts, 74 of which are new entries to the previous edition. GRA

N79-11551# National Technical Information Service, Springfield, Va.

DESIGN AND APPLICATIONS OF FLYWHEELS. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Sep. 1978

Guy E. Habercom, Jr. Sep. 1978 228 p Supersedes NTIS/PS-77/0883; NTIS/PS-76/0768

(NTIS/PS-78/0998/1; NTIS/PS-77/0883; NTIS/PS-76/0768) Avail: NTIS HC $28.00/MF $28.00 CSCL 13I

A worldwide literature survey was conducted to obtain information on the design and varied applications of flywheels and reaction wheels. Such diversified applications as satellite stabilization, surface vehicle propulsion, energy transfer devices, and inertia or friction welding are reviewed. This updated bibliography contains 222 abstracts, 42 of which are new entries to the previous edition. GRA

N79-11552# National Technical Information Service, Springfield, Va.

ENERGY POLICY AND RESEARCH PLANNING, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1976 - Sep. 1977

Audrey S. Hundemann Sep. 1978 240 p

(NTIS/PS-78/0961/9) Avail: NTIS HC $28.00/MF $28.00 CSCL 10A

Energy planning for future U.S. energy needs on both national and state government levels is discussed. The history and development of national and state legislation and regulations, Project Independence studies, and assessment of the effects of deregulation are presented. Technical, economic, and environmental considerations in energy planning are also covered. This updated bibliography contains 233 abstracts, none of which are new entries to the previous edition. GRA

N79-11553# National Technical Information Service, Springfield, Va.

ENERGY POLICY AND RESEARCH PLANNING, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Oct. 1977 - Sep. 1978

Audrey S. Hundemann Sep. 1978 91 p Supersedes NTIS/PS-77/0839; NTIS/PS-76/0710; NTIS/PS-75/630

(NTIS/PS-78/0962/7; NTIS/PS-77/0839; NTIS/PS-76/0710; NTIS/PS-75/630) Avail: NTIS HC $28.00/MF $28.00 CSCL 10A

Citations relative to planning for future U.S. energy needs on both national and state government levels are presented. The history and development of national and state legislation and regulations, Project Independence studies, and assessment of the effects of deregulation are included. Technical, economic, and environmental considerations in energy planning are also covered. This updated bibliography contains 85 abstracts, 83 of which are new entries to the previous edition. GRA

N79-11554# Johns Hopkins Univ., Laurel, Md.

ENERGY PROGRAMS AT THE JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY Quarterly Report, Jan. - Mar. 1978

Mar. 1978 42 p refs 2 Vol.

(PB-283171/7; APL/JHU-EQR/78-1) Avail: NTIS HC A03/MF A01 CSCL 10A

The first section of the report contains short descriptions of meetings, trips, presentations, and other limited tasks of note performed in connection with the major program tasks. The second section contains articles on the following subjects: (1) scenarios for the use of energy available from hot dry rock and for geothermal energy use in South Dakota and in the eastern Gulf coastal plain; (2) progress monitoring and reporting system and data base for Geothermal Region 5; (3) a study of geothermal energy applicatons in the Atlantic coastal plain; (4) institutional problems for low-head hydroelectric power development in New England; (5) an insurance modeling project; (6) storage of electrical energy by flywheel and battery at small hydroelectric sites; (7) a Community Annual Storage Energy System (CASES); (8) development and demonstration plan for a low-cost flywheel; and (9) multiple-objective modeling of power plant locations. GRA

N79-11555# Johns Hopkins Univ., Laurel, Md.

ENERGY PROGRAMS AT THE JOHNS HOPKINS UNIVERSITY APPLIED PHYSICS LABORATORY Quarterly Report, Oct. - Dec. 1977

Dec. 1977 43 p refs Sponsored by DOE 2 Vol.

(PB-283170/9; APL/JHU-EQR/77-4) Avail: NTIS HC A03/MF A01 CSCL 10A

The first section of the report contains short descriptions of meetings, trips, presentations, and other limited tasks of note performed in connection with the major program tasks. The second section contains articles on the following subjects: (1) scenarios for geothermal energy use in South Dakota, the Atlantic coastal plain, the eastern Gulf coastal plain, and Arkansas; (2) use of the energy available from hot dry rock; (3) a progress monitoring and reporting system and data base for DOE Geoethermal Region 5; (4) a fact sheet on the redevelopment of old hydroelectric power dams in New England; (5) institutional problems for low-head hydroelectric power development in New England; (6) storage of electrical energy by the electrolysis of water; (7) an insurance modeling project; (8) a Community Annual Storage Energy System; (9) and a development and demonstration plan for a low-cost flywheel. GRA

N79-11556# Office of Technology Assessment, Washington, D. C.

RENEWABLE OCEAN ENERGY SOURCES. PART 1: OCEAN THERMAL ENERGY CONVERSION

May 1978 50 p refs

(PB-283104/8; OTA-0-62; LC-78-600053) Avail: NTIS HC A03/MF A01 CSCL 10B

The current status of OTEC technology is reported, with particular attention to areas in which significant problems exist. The economic considerations which are pertinent to an OTEC system are discussed, and economic problems facing some of the products most often suggested for OTEC production are outlined. The present and possible future Government role in funding OTEC research is reported. GRA

N79-11557# Office of Technology Assessment, Washington, D. C.

RENEWABLE OCEAN ENERGY SOURCES. PART 1: WORKING PAPERS. OCEAN THERMAL ENERGY CONVERSION

May 1978 127 p refs

(PB-283103/0; OTA-0-63) Avail: NTIS HC A07/MF A01 CSCL 10B

The discussions of the historical development of the OTEC concept (including the open-, closed-, and low temperature difference- cycles), the resource potential of ocean thermal gradients, markets and products for OTEC, development status and technical problem areas are reported. Economic factors and environmental concerns are also treated. The shore-based and open-ocean OTEC sites are presented. GRA

N79-11558# National Bureau of Standards, Washington, D. C. Center for Mechanical Engineering and Process Technology

COMMITTEE ON THE CHALLENGES OF MODERN SOCIETY RATIONAL USE OF ENERGY PILOT STUDY MODULAR

INTEGRATED UTILITY SYSTEM PROJECT. VOLUME 2: MINUTES OF PROJECT MEETING Final Report
M. H. Nimmo and C. W. Phillips Jun. 1978 147 p Sponsored in part by Dept. of Housing and Urban Development, Wash. D.C.
(PB-283429/9; NBSIR-78-1468-2-Vol-2; Nato/CCMS-74/2) Avail: NTIS HC A07/MF A01 CSCL 13A

A description of the project, its objectives, the chronology of the project, a description of its activities and products, copies of its products and minutes of its meetings are reported. The progress of each activity and product is discussed, the committee's recommendations are given. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N79-11559 *Ohio State Univ., Columbus.*
THE PRESERVATION OF THE STATISTICAL STRUCTURE IN TURBULENT LAKE TRANSPORT COMPUTATIONS Ph.D. Thesis
Christos Babajimopoulos 1978 354 p
Avail: Univ. Microfilms Order No. 7819559

A mathematical filter is developed which removes the smaller than the grid size scales and leaves the larger ones to be computed by the equations. As a result of this filtering procedure, in addition to Reynolds stresses, second order corrective differential terms arise. A differencing scheme of fourth order accuracy is used for the computation of all the spatial differentials. The remaining Reynolds stresses are accounted by considering the inertial subrange Kolmogorov's five-thirds law. A method of model verification, which is based on the comparison of the computed velocity and concentration spectral is described. This is more reliable and it is much easier to collect data, since it requires no more than velocity histories at certain points in the lake for preliminary model verification. It is concluded that filtration of the transport equations is a necessary procedure in describing the turbulent lake transport process. Dissert. Abstr.

N79-11560*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
ELEMENTAL CHARACTERISTICS OF AEROSOLS EMITTED FROM A COAL-FIRED HEATING PLANT
Jag J. Singh and G. S. Khandelwal (Old Dominion Univ., Norfolk, Va.) Nov. 1978 21 p refs
(NASA-TM-78749; L-12427) Avail: NTIS HC A02/MF A01 CSCL 13B

Size differentiated aerosols were collected downstream from a heating plant fueled with eastern coal and analyzed using particle induced X-ray emission technique. Based on aerosol masses collected in various size ranges, the aerosol size distribution is determined to be trimodal, with the three peaks centered at 0.54 microns, 4.0 microns, and 11.0 microns, respectively. Of the various trace elements present in the aerosols, sulphur is the only element that shows very strong concentration in the smallest size group. Iron is strongly concentrated in the 4.0 micron group. Potassium, calcium, and titanium also exhibit stronger concentration in the 4.0 micron group than any other group. Other trace elements - vanadium, chromium, manganese, nickel, copper, and barium - are equally divided between the 0.54 microns and the 4.0 microns groups. Apparently, all of the trace elements - except S - enter aerosols during the initial formation and subsequent condensation phases in the combustion process. Excess concentration of sulphur in the 0.54 microns group can only be accounted for by recondensation of sulphur vapors on the combustion aerosols and gas-to-particle phase conversion of sulfate vapors at the stack top. Author

N79-11561# National Aviation Facilities Experimental Center, Atlantic City, N. J.
EMISSION SAMPLE PROBE INVESTIGATION OF A MIXED FLOW JT8D-11 TURBOFAN ENGINE Final Report, Jan. 1973 - Jun. 1977
Gerald R. Slusher Jul. 1978 64 p refs
(AD-A058038 FAA-NA-77-40, FAA-RD-77-175) Avail: NTIS HC A04/MF A01 CSCL 14/2

The exhaust plume of a mixed flow JT8D-11 turbofan engine was investigated to optimize the shape, size, and location of fixed probes for acquiring representative emission samples. Traverse of 177 points over the exhaust nozzle were accomplished on a 2 inch square grid. The average emission levels, contours, and profile distributions were determined. The predicted performance of area weighted cruciform and diamond probe designs were calculated from interpolations of the traverse contours. Exhaust emissions were measured with: (1) five mixing cruciform probes, (2) multihole averaging probes in core, and (3) the engine turbine discharge pressure probes. Detailed traverses across engine power are considered necessary for representative emission measurement because of limitations existing in all fixed probing techniques investigated. S.B.S.

N79-11562# National Aviation Facilities Experimental Center, Atlantic City, N. J.
PILOT PROGRAM TO DEVELOP OPERATING TIME EMISSION DEGRADATION FACTORS FOR GENERAL AVIATION PISTON ENGINES Final Report, Jun. - Oct. 1977
Robert F. Salmon Jul. 1978 66 p refs
(AD-A058158; FAA-NA-78-25; FAA-RD-78-74) Avail: NTIS HC A04/MF A01 CSCL 13B

Two aircraft were used as test vehicles to determine emission degradation characteristics of piston engines over a time period of 50 hours. The results indicate that (1) no appreciable change in emissions occurs within the first 50 hours of engine operation, (2) emissions can be measured on aircraft-installed engines with accuracies comparable to those obtained in test stands, provided proper instrumentation and test procedures are used, and (3) aircraft instrumentation is satisfactory for some parameters, but in order to achieve EPA accuracy requirements, manifold pressure, fuel flow, and induction airflow must be measured on laboratory-type instruments. S.B.S.

N79-11563# Radford Army Ammunition Plant, Va.
NITROFORM RECOVERY AND ISOLATION STUDIES Final Report, Dec. 1975 - Jan. 1978
R. A. Mundy and E. E. Gilbert May 1978 72 p
(AD-A056244; AD-E400164; RAD-240.10; PE-557) Avail: NTIS HC A04/MF A01 CSCL 19/1

An investigation was made to effectively remove tetranitromethane (TNM) from the effluent gas stream from trinitrotoluene (TNT) manufacturing operations and convert it to nitroform (NF). The TNM was efficiently removed by passing the gas through a column scrubber containing an aqueous solution of sodium carbonate (Na_3CO_3) and stabilized hydrogen peroxide (H_2O_2). The resulting sodium nitroform (SNF) solution can be vacuum distilled to obtain NF which is a marketable by-product.
Author (GRA)

N79-11564# Naval Postgraduate School, Monterey, Calif.
A COMPUTER SUBROUTINE FOR STRESS ANALYSIS OF ROTATING, HEATED DISKS
John E. Brock and Robert E. Brown May 1978 24 p refs
(AD-A056295; NPS-69-78-012) Avail: NTIS HC A02/MF A01 CSCL 13/2

This report gives listing and instructions for using a digital computer subroutine for finding stress distribution in a thin rotating disk with nonuniform heating; the problem is axisymmetric. An iterative method is used. Theoretical background is given.
Author (GRA)

N79-11565# Naval Postgraduate School, Monterey, Calif.
SENSITIVITY OF AQAM PREDICTIONS FOR NAVAL AIR OPERATIONS TO METEOROLOGICAL AND DISPERSION MODEL PARAMETERS
David W. Netzer May 1978 64 p refs
(AD-A056296; NPS-67NT78051) Avail: NTIS HC A04/MF A01 CSCL 13/2

Ground level pollution concentrations have been calculated at a Naval Air Station using a modified Air Quality Assessment model. The sensitivity of model predictions to varying meteorological conditions and assumed dispersion model parameters were determined. Optimum receptor locations for model validation efforts were identified. Author (GRA)

N79-11566# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
COMMUNITY NOISE EXPOSURE RESULTING FROM AIRCRAFT OPERATIONS. VOLUME 6: ACOUSTIC DATA ON NAVY AIRCRAFT
Jerry D. Speakman, Robert G. Powell, and Robert A. Lee Mar. 1978 510 p
(AD-A056217; AMRL-TR-73-110-Vol-6) Avail: NTIS HC A22/MF A01 CSCL 20/1

This series of reports presents the results of field test measurements to define the noise produced on the ground by military, fixed wing aircraft during controlled level flyovers and ground runups. For flight conditions, data are presented in terms of various acoustic measures over the range 200-25,000 feet minimum slant distance to the aircraft. For ground runups, data are presented as a function of angle and distance to the aircraft. All of the data are normalized to standard acoustic reference conditions of 59 F temperature and 70% relative humidity. Noise data are presented in this volume for the following aircraft: A-3, TA-4J; RA-56; A-6A; AV-8A; F-8; F-14A; P-3A; S-3A; and T-2C. GRA

N79-11567# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
EFFECTS OF CATALYTIC REACTORS ON DIESEL EXHAUST COMPOSITION
W. F. Marshall, D. E. Seizinger, and R. W. Freedman Apr. 1978 12 p refs
(BM-TPR-105) Avail: NTIS HC A02 MF A01

Tests conducted with four different catalytic reactor designs to determine the influences of exhaust treatment systems on emissions from diesel engines are discussed. Although there was significant differences in oxidation efficiencies at light to intermediate engine loads, all four catalysts were very effective in reducing emissions at heavy loads. Compositional determinations included carbon monoxide, carbon dioxide, unburned hydrocarbons, oxides of nitrogen, aldehydes, sulfur dioxide, sulfates, and particulate loading. Particulate size, exhaust odor intensity, and the character of the unburned hydrocarbon component were also determined. DOE

N79-11568# Oak Ridge National Lab., Tenn.
ENERGY-RELATED POLLUTANTS IN THE ENVIRONMENT: THE USE OF SHORT-TERM FOR MUTAGENICITY IN THE ISOLATION AND IDENTIFICATION OF BIOHAZARDS
J. L. Epler, F. W. Larimer, T. K. Rao, C. E. Nix, and T. Ho 1978 31 p refs Presented at the Higher Plant Systems as Monitors of Environ. Mutagens, Marineland, Fla., 16 Jan. 1978 Sponsored in part by EPA
(Contract W-7405-eng-26)
(CONF-780121-2) Avail: NTIS HC A03/MF A01

The potential genetic hazards of existing or proposed energy generating or conversion systems were investigated. To approach the problems of dealing with and the testing of large numbers of compounds, a form of the tier system was used. Operating units utilizing Salmonella, E. coli, yeast, human leukocytes, mammalian cells, and Drosophila were initiated. Various liquid-liquid extraction methods and column chromatographic separations were applied to crude products and effluents from oil shale, coal liquefaction and coal gasification processes. Mutagenicity of the various fractions was assayed using reversion of histidine-requiring auxotrophs of Salmonella typhimurium and comparative studies were carried out with the other genetic systems. In order to incorporate metabolic activation of these fractions and compounds, rat liver homogenates were used in the various assays. Results implicate chemicals occurring in the basic and the neutral fractions as potential genetic hazards. Chemical constituents of these fractions (identified or predicted) were tested individually for their mutagenic activity and correlated with the genetic monitoring. DOE

N79-11569# Department of Energy, Washington, D. C.
ENVIRONMENTAL DEVELOPMENT PLAN (EDP): UNDERGROUND COAL CONVERSION PROGRAM, FY 1977
Mar. 1978 170 p refs
(DOE/EDP-0011) Avail: NTIS HC A08/MF A01

Underground Coal Gasification (UCG) is one of several coal gasification technologies which when commercialized will allow for greater utilization of the nation's vast coal resources. There are certain environmental impacts unique to UCG processes that must be assessed before commercialization can occur. The most significant impacts are potential ground-water pollution, subsidence, and disruption of acquifers. These impacts are discussed more fully in this EDP. Most of the environmental research performed to date has addressed the characterization of the raw product gas, hydrocarbon liquids, and groundwater contamination. These EDP's are being distributed so that all having interests and responsibilities may assist in a planned revision and update. DOE

N79-11570# Oak Ridge National Lab., Tenn.
NONPROLIFERATION ALTERNATIVE SYSTEMS ASSESSMENT PROGRAM (NASAP): PRELIMINARY ENVIRONMENTAL ASSESSMENT OF THORIUM/URANIUM FUEL CYCLE SYSTEMS
H. R. Meyer, J. E. Till, and E. A. Bondietti Jun. 1978 29 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6069) Avail: NTIS HC A03/MF A01

A preliminary assessment is presented of the quality of existing information available for the evaluation of potential environmental impacts resulting from large-scale implementation of a thorium-based fuel cycle. The report's purpose includes: (1) assistance in the development of a hazard assessment policy for the Nonproliferation Alternative Systems Assessments Program (NASAP) sponsored by the Department of Energy, and (2) identification of areas in which further research is necessary to allow detailed evaluation of the environmental hazards associated with thorium fuel cycles in general. Both the hazard assessment data base and the available assessment methodology are evaluated. DOE

N79-11571# California Univ., Livermore. Lawrence Livermore Lab.
MATHEW: A MASS-CONSISTENT WIND FIELD MODEL Ph.D. Thesis
C. S. Sherman May 1978 99 p refs
(Contract W-7405-eng-48)
(UCRL-52479) Avail: NTIS HC A05/MF A01

A regional three-dimensional time-independent wind field model was developed. It utilizes a variational analysis technique to determine a three-component non-divergent velocity field which can be used to provide the advection velocities in atmospheric pollutant transport and diffusion models. The regions of interest have horizontal distances of 10 to 200 km and extend less than 2 km above topography. DOE

N79-11572# Brookhaven National Lab., Upton, N. Y.
ENVIRONMENTAL CONTROL TECHNOLOGY FOR ATMOSPHERIC CARBON DIOXIDE Quarterly Progress Report, 20 Jun. - 30 Sep. 1977
M. Steinberg, A. S. Albanese, and V. D. Dang Oct. 1977 18 p refs
(Contract EY-76-C-02-0016)
(BNL-50794; QPR-1) Avail: NTIS HC A02/MF A01

Background information is given on: (1) the concentration levels of CO2 in the atmosphere during the last one hundred years; (2) the possible effects of rising CO2 levels; (3) the impact of fossil fuel use in the United States on overall worldwise CO2 emissions; (4) the impact of increased coal utilization on CO2 emissions; and (5) process considerations for controlling CO2. DOE

N79-11573# United Kingdom Bird Impact Research and Development Committee, London (England).
GUIDANCE FOR THE SITING AND MAINTENANCE OF RUBBISH TIPS, SEWAGE WORKS AND OUTFALLS, QUARRIES AND RESERVOIRS ADJACENT TO AERODROMES
Feb. 1977 6 p Revised
(Rept-3; BR57282) Avail: NTIS HC A02/MF A01

An assessment is given of man-made food sources, such as rubbish dumps, near airports and their attraction to birds which hazard aircraft. Measures to reduce hazards from birds are also briefly reviewed. ESA

N79-11574# SRI International Corp., Menlo Park, Calif.
SITE SELECTION FOR THE MONITORING OF PHOTOCHEMICAL AIR POLLUTANTS
F. L. Ludwig and E. Shelar Apr. 1978 139 p refs
(Contract EPA-68-02-2028)
(PB-283404/2; EPA-450/3-78-013) Avail: NTIS HC A07/MF A01 CSCL 13B

A site typology based on spatial representativity with subcategories dependent on more specialized monitoring objectives (source oriented, product - oriented, or reactant-oriented objectives) is presented. The requirements for locating the different types of monitoring station have been outlined in flow chart form. Topics include the (1) classifying of monitoring objectives for the major pollutants involved in atmospheric photochemical reactions--the nonmethane hydrocarbons (NMHC), nitric oxide, (NO) nitrogen dioxide (NO2), and oxidants (Ox)--(2) devising of a set of monitoring station types to meet those objectives; and finally (3) prescribing of procedures for identifying suitable locations for the different types of monitoring stations. GRA

N79-11575# Southern Research Inst., Birmingham, Ala.
A DATA REDUCTION SYSTEM FOR CASCADE IMPACTORS Final Report, Mar. - May 1978
J. D. McCain, G. I. Clinard, L. G. Felix, and J. W. Johnson Jul. 1978 44 p refs
(Contract EPA-68-02-2131)
(PB-283173/3; EPA-600/7-78-132A; SORI-EAS-78-331) Avail: NTIS HC A03/MF A01 CSCL 13B

The system utilizes impactor-specific calibration information, together with operating conditions and other pertinent information (e.g., stage weights, sampling duration), to determine particle size distributions in several forms for individual runs. The program can handle all commercial round-jet cascade impactors, including common modifications, which are in use in stack sampling. A spline technique is applied to fit a curve in the cumulative size distribution obtained from each individual impactor run. The fitted curves have forced continuity in coordinates and slopes. Size distribution averages for multiple runs are made using the fitted curves for interpolation at consistent particle diameters, regardless of the diameters at which the data points fall in the original individual run data sets. After statistical analyses to locate and remove outliers from the data being averaged, variances, standard deviations, and confidence intervals are calculated. The averages and statistical information are available in tables and graphs in several size distribution formats. GRA

N79-11576# IIT Research Inst., Chicago, Ill.
EXPERIMENTAL QUANTITATIVE TRANSPORT PROBE AND CONTROL BOX SAMPLING SYSTEM Final Report
Madhav B. Ranade Jun. 1978 47 p refs
(Contract EPA-68-02-2434)
(PB-283656/7; EPA-600/2-78-109) Avail: NTIS HC A03/MF A01 CSCL 14B

Three quantitative sampling transport probe and control box sampling systems were designed and fabricated. The systems are designed to permit the transport of samples of aerosols from a source to a sensor without significant modification of mass rate and size distribution of the sample aerosols. Descriptions of the systems are given. An operating manual is included. Results of functional tests demonstrated that the systems operate as designed with the exception of pumping rates. GRA

N79-11577# Environmental Protection Agency, Research Triangle Park, N.C. Monitoring and Data Analysis Div.
AIR QUALITY DATA: 1977 THIRD QUARTER STATISTICS Quarterly Report, Jul. - Sep. 1977
May 1978 127 p
(PB-283160/0; EPA-450/2-78-017) Avail: NTIS HC A07/MF A01 CSCL 13B

Ambient air quality submitted to EPA from air monitoring operations of state, local and federal networks in accordance with requirements of the Clean Air Act and EPA regulations for state implementation plans are presented. These data represent all ambient air quality data sampled for pollutants that have national ambient air quality standards. GRA

N79-11578# Applied Meteorology, Inc., Houston, Tex.
VISIBILITY ASSESSMENT PROJECT Final Report
10 Jan. 1978 96 p Sponsored by Houston Chamber of Commerce
(PB-283228/5; HAOS-03) Avail: NTIS HC A05/MF A01 CSCL 04A

Human observers at seven locations in and around Houston made visibility measurements using the 'visibility-marker recognition' technique. These observations were made as a part of the Houston area oxidants study, and are to provide human visibility measurements that can be correlated to telephotometer visual range measurements that were made at one location in downtown Houston. GRA

N79-11579# Aeromet, Inc., Tulsa, Okla.
SUMMARY OF LOW LEVEL SOUNDINGS COLLECTED FOR THE HOUSTON AREA OXIDANTS STUDY Final Report
Phil Stickel 13 Apr. 1978 54 p Sponsored by Houston Chamber of Commerce Prepared for Radian Corp., Austin, Tex.
(PB-283230/1; HAOS-06) Avail: NTIS HC A04/MF A01 CSCL 04A

Low level temperature and wind data collected for the city of Houston over the period from June 15 to October 23, 1977 are presented. Collected data are validated and analyzed. The scope of the study is explained, and conclusions are presented. Recommendations for changes in the study are also given. The data were collected over a wide spectrum of conditions and require intensive study for valid conclusions to be made. GRA

N79-11580# Acurex Corp., Mountain View, Calif. Aerotherm Div.
JET ENGINE TEST CELLS: EMISSIONS AND CONTROL MEASURES, PHASE 1 Final Report, 13 Aug. 1976 - 30 Sep. 1976
D. E. Blake Apr. 1978 139 p refs
(Contract EPA-68-01-3158)
(PB-283470/3; Aerotherm-FR-76-218; TR-78-102; EPA-340/1-78-001A) Avail: NTIS HC A07/MF A01 CSCL 13B

The current state of the art of pollutant emission measurement and cleanup technology related to military jet engine test cells are discussed. Considerable emissions data from jet engines is available, but data from test cell stacks is sparse. An electrostatic precipitator, nucleation scrubber, fuel additives, thermal converter, and fuel atomization improvement were evaluated. Several methods are quite effective in reducing test cell emissions. Fuel additives are effective in reducing test cell plume opacity. Capital and operating cost data on these methods are presented. GRA

N79-11581# Technology Service Corp., Santa Monica, Calif.
USE OF METEOROLOGICAL DATA IN AIR QUALITY TREND ANALYSIS
Melvin D. Zeldin and William S. Meisel May 1978 101 p refs
(Contract EPA-68-02-2318)
(PB-283448/9; EPA-450/3-78-024) Avail: NTIS HC A06/MF A01 CSCL 04A

Methods for meteorologically adjusting air quality trends were surveyed. Known relationships between specific air pollutants and various meteorological parameters are given. A recommended methodology to normalize air quality trends with respect to typical year meteorology is presented. Procedures involve the determination of mutually exclusive meteorological classes and the treatment of air quality variables stratified according to the established meteorological classes. A hypothetical example is included to illustrate both the mathematical processes and the interpretation of the methodological results. GRA

N79-11582# Monsanto Research Corp., Dayton, Ohio.
SOURCE ASSESSMENT: POLYVINYL CHLORIDE
Z. S. Khan and T. W. Hughes May 1978 107 p refs
(Contract EPA-68-02-1874)
(PB-283395/2; MRC-DA-700; EPA-600/2-78-004-I) Avail: NTIS HC A06/MF A01 CSCL 07A

Data on air emissions from the polyvinyl chloride (PVC) industry are summarized. A representative PVC plant was defined to assess the severity of emissions from this industry. Source severity, defined as the ratio of the time-averaged maximum

ground level concentration of a pollutant to a hazard potential was calculated for 16 chemical species emitted from a representative plant. The two largest severities were 970 for vinyl chloride and 1.9 for PVC. Control technology for hydrocarbons includes adsorption, absorption, refrigeration, incineration, stripping, purging of equipment with inert gas or water, and control of fugitive emissions. GRA

N79-11583# National Technical Information Service, Springfield, Va.
MANEUVERING AIRCRAFT: NOISE POLLUTION AND CONTROL, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - 1975
Guy E. Habercom, Jr. Sep. 1978 187 p
(NTIS/PS-78/0929/6) Avail: NTIS HC $28.00/MF $28.00 CSCL 20A

Methods for alleviating noise created by maneuvering aircraft are cited. Flyby, turning flight, takeoffs and landings are the maneuvers investigated. This bibliography contains 181 abstracts. GRA

N79-11584# National Technical Information Service, Springfield, Va.
MANEUVERING AIRCRAFT: NOISE POLLUTION AND CONTROL, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS
Guy E. Habercom, Jr. Sep. 1978 147 p Supersedes NTIS/PS-77/0786; NTIS/PS-76/0733; NTIS/PS-75/762; NTIS/PS-75/060 (NTIS/PS-76/0733; NTIS/PS-75/762; NTIS/PS-75/060; NTIS/PS-78/0930/4; NTIS/PS-77/0786) Avail: NTIS HC $28.00/MF $28.00 CSCL 20A

A continuation of methods for alleviating noise created by maneuvering aircraft is presented. Flyby, turning flight, takeoffs, and landings are the maneuvers investigated. This bibliography contains 141 abstracts. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N79-11585 Wisconsin Univ. - Madison.
MEASUREMENT OF UPPER CONVECTIVE BOUNDARY LAYER PARAMETERS BY MEANS OF LIDAR Ph.D. Thesis
Kenneth Edward Kunkel 1978 143 p
Avail: Univ. Microfilms Order No. 7814271

Data obtained over Madison, Wisconsin, over a three year period from 1975 to 1977 primarily during the spring, summer and fall are presented. Aspect ratios of convective cells were measured using lidar RHI scans vary from .5 to 1.5. Lidar measurements of circulation patterns around convective cells show that the strongest rising motion occurs on the upwind side of the circulation pattern while compensating sinking motion occurs on the downwind side. These observations also confirm the importance of the inversion height as a length scale in convective situations. Turbulent velocity measurements combined with lidar measurements of the inversion height were used to calculate the energy dissipation. The results agreed with local tower measurements. Dissert. Abstr.

N79-11586 Texas Univ. at Austin.
NUMERICAL SIMULATIONS OF ATMOSPHERIC CONVECTION OVER THE SOUTHEASTERN US IN UNDISTURBED CONDITIONS Ph.D. Thesis
Alfred Julius Garrett 1978 373 p
Avail: Univ. Microfilms Order No. 7817636

A physically comprehensive, three dimensional, time dependent, primitive equation model of the atmosphere was developed for use as a research tool in an investigation of atmospheric convection. Equations describing soil physics, a layer of vegetation, cloud formation and the transfer of solar and terrestrial radiation are included. Four types of clouds are simulated by the model: cirrus, stratocumulus, shallow cumulus and cumulonimbus clouds are able to generate rain, which is absorbed by the soil layer. The atmospheric boundary layer of the model is assumed to be well-mixed and grows according to entrainment theory. The predicted distributions of atmospheric temperature, moisture, cloud cover and rainfall agreed fairly well with the observed distributions. The model also made good forecasts of the onset of thunderstorm activity on the test days. The success of this model indicates that operational numerical weather prediction models should use less empiricism and more physics in their convective rainfall parameterizations. Dissert. Abstr.

N79-11587 Arizona Univ., Tucson.
A ROCKET-BORNE FIELD IONIZATION MASS SPECTROMETER, AND ITS MEASUREMENT OF NEUTRAL NITROGEN/OXYGEN CONCENTRATIONS IN THE THERMOSPHERE Ph.D. Thesis
Charles Christopher Curtis 1978 115 p
Avail: Univ. Microfilms Order No. 7818616

On January 14, 1977, the first field ionization neutral particle mass spectrometer to operate in the upper atmosphere was launched by a sounding rocket from the Poker Flat Research Range near Fairbanks, Alaska. The mass spectrometer demonstrated the feasibility of employing field ionization teachniques in rocket-borne devices, and collected useful data concerning the nitrogen/oxygen density profile in the altitude range 170 to 350 kilometers. The spectrometer was launched during a period of auroral activity, and transmitted data indicating the presence of thermospheric density or velocity disturbances in the region between 215 and 246 kilometers. Three possible causes for the fluctuations are given. Dissert. Abstr.

N79-11588 Columbia Univ., New York.
VARIATIONAL PRINCIPLES FOR TRANSIENT ELECTROMAGNETICS AND THEIR APPLICATIONS TO THE EXPLORATION OF DEEP-SEATED MINERAL DEPOSITS Ph.D. Thesis
Dong-heng Cho 1978 75 p
Avail: Univ. Microfilms Order No. 7819313

Two variational principles are derived. The first one of the Gurtin type, is deduced from the integrodifferential equations equivalent to the electromagnetic field equations. The initial conditions are implicitly included in the variational principle. The second one is a simplified version of the first variational principle. The first variations of these two variational principles are equivalent in virtue of the Herrera-Bielak's theorem. The variational field equations are casted into the form suitable for a finite-element formulation in space. The related matrix equation for a time-harmonic case can also be derived as a special case of general field equation. An explicit central-differences scheme in time is then applied to variational field equation to finally yield a recursive relation for time stepping. These principles are then used to verify the Newmont Electromagnetic Pulse survey done in the Mutooroo prospect in Australia. Dissert. Abstr.

N79-11589 Cornell Univ., Ithaca, N. Y.
AN INSTRUMENT SYSTEM TO MEASURE THE VERTICAL DISTRIBUTION OF OZONE IN THE LOWER TROPOSPHERE Ph.D. Thesis
Paul Steven Sanik 1978 188 p
Avail: Univ. Microfilms Order No. 7817841

The instrument system described is capable of measuring directly the temperature, pressure, and ozone concentration in the first 1500 m of the atmosphere. The system operates in real-time, sending data in a time-multiplexed format by a 1.68 GHz telemetry link to a ground-based observer. The received data may be digitally displaced for immediate use, and may also be recorded on a standard audio tape cassette for later use. The results illustrate the nature of the local changes of ozone concentration and are consistent with the thesis of in-situ photochemical production of ozone in the atmospheric boundary layer. Several mechanisms of transportation of ozone from the stratosphere to the troposphere to are discussed, as are mechanisms of production of ozone within the troposphere. Dynamical influences on both the horizontal and vertical transport of ozone are also covered. Dissert. Abstr.

N79-11590 Cornell Univ., Ithaca, N. Y.
INCOHERENT SCATTER MEASUREMENTS OF THE MOTIONS OF H(PLUS) AND O(PLUS) IN THE TOPSIDE

IONOSPHERE Ph.D. Thesis
James Frederick Vickrey 1978 205 p
Avail: Univ. Microfilms Order No. 7817847

Measurements are presented from the post sunset period of August 6, 1975 and from two diurnal periods, August 15-16, 1976 and January 15-16, 1977. These measurement indicate that velocity differences between the H+ and O+, ions present in the topside ionosphere are commonplace. Not only are the magnitudes of the individual ion velocities different, but the velocities are at times in opposite directions. Failure to measure the individual velocities of H+ and O+ when they are present in comparable abundances, can lead to errors in estimating the net ionization transport flux to and from the protonosphere. Observations show significant day to day variability in the structure and dynamics of the topside ionosphere. A consistent feature, however, is that the temporal behavior of the H+ and O+ fluxes is similar at high altitudes where the ion height distributions are governed by diffusion. This similarity is lost at low altitudes where chemical equilibrium of the charge exchange reactions bewteen H+, O, O+ and H dominate the ion height distributions. Dissert. Abstr.

N79-11591*# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
EFFECTS OF ATMOSPHERE, TEMPERATURE AND EMITTANCE ON REFLECTED AND EMITTED ENERGY
Ravindra Kumar Sep. 1977 12 p refs
(NASA-CR-154876; INPE-1121-PE/089) Avail: NTIS HC A02/MF A01 CSCL 04A

The effects of temperature and emittance on the relative magnitude of reflected energy and emitter energy from a target including atmospheric effects was studied. From the calculations of energy reflected and emitted from a target including atmospheric effects using LOWTRAN 3 programs for midlatitude summer model, the following conclusions were obtained: (1) At 3.5 micrometers q is considerably less than 1 except at high temperatures and for high emittance; (2) at 4 micrometers q is of the order of magnitude equal to 1 for most targets; and (3) at 4.6 micrometers, q is considerably greater than 1 at high temperatures and high emittance. In addition, incident atmospheric emission reflected from the target was found to be negligible except for targets having low temperature and low emittance. B.B.

N79-11592# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
BASIC PRINCIPLES OF INCOHERENT SCATTERING AND ITS CONTRIBUTION TO PHYSICAL STUDIES OF THE UPPER ATMOSPHERE [PRINCIPIOS BASICOS EM ESPALHAMENTO INCOGRENTE E SUA CONTRIBUICAO PARA O ESTUDO DA FISICA NA ATMOSFERA SUPERIOR]
Volker W. J. H. Kirchhoff Sep. 1977 17 p refs In PORTUGUESE; ENGLISH summary
(INPE-1114-PE/084) Avail: NTIS HC A02/MF A01

The theory of incoherent scatter is presented from a practical point of view. Considerations on frequency of operation, spectrum, equipment and data analysis were reviewed and its contributions to the study of the upper atmosphere and ionosphere are summarized. The description stresses the physical processes rather than the mathematical treatment. B.B.

N79-11593# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
PHYSICS OF THE IONOSPHERE [IONOSFERA - ATMOSFERA SUPERIOR FISICA]
Jose Augusto Bittencourt Jan. 1978 53 p refs In PORTUGUESE
(INPE-1191-NTE/111) Avail: NTIS HC A04/MF A01

A review of the basic concepts of ionospheric physics is presented. The dynamics of the upper neutral atmosphere related to studies of the ionosphere, the formation of the ionosphere, the differences in the various ionospheric layers, physical and chemical processes, ionospheric phenomenon, wave propagation, and a method for measuring ionospheric plasma parameters are presented. Transl. by F.O.S.

N79-11594# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ANNUAL AND SEMI-ANNUAL VARIATION IN THE H-FIELD AT VASSOURAS
N. B. Trivedi, I. J. Kantor, and J. M. DaCosta Jan. 1978 15 p refs
(INPE-1189-PE/109) Avail: NTIS HC A02/MF A01

Vassouras H-field data during the period 1957-68 were subjected to harmonic analysis and spectrum analysis by the maximum entropy method. The amplitudes of the annual and semi-annual components were computed. Similar computations were carried out for equatorial Dst data for the period 1957-70 and amplitudes of annual and semi-annual waves were computed. The results are discussed and compared. It seems that the annual wave could have a significant contribution from currents of magnetospheric origin. B.B.

N79-11595# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STRATOSPHERIC DUST MEASUREMENTS, 1970 - 1977
B. R. Clemesha and D. M. Simonovich Oct. 1977 26 p refs
(INPE-1138-PE/097) Avail: NTIS HC A03/MF A01

Stratospheric aerosol measurements were made by laser radar at Sao Jose dos Campos (23 S, 46 W) since July 1970. The measured scattering rations from 1970 to 1974 for the 20 km layer were similar to those reported for other locations. A large increase was observed in April 1975, six months after the eruption of Volcan de Fuego in Guatemala. This delay in the transport of the Fuego dust to our latitude is interpreted as being due to the inhibition of southward eddy transport, during the southern summer, by the mean meridional circulation. A maximum monthly average scattering ratio of 1.28 measured at a wavelength of 5890 A, was observed at 20 km in August 1975. Since early 1976 the 20 km scattering ratio has oscillated around a value of about 1.15, but the integrated columnar backscattering coefficient above 17 km, indicative of the total stratospheric dust loading, has increased by about 40%. Scattering from the upper stratosphere, at heights above 30 km, was observed in the southern springs of 1971, 1972 and 1973. Author

N79-11596*# Stanford Univ., Calif. Institute for Plasma Research.
THE EQUATORIAL ROTATION VELOCITY OF THE PHOTOSPHERE IS MEASURED TO BE THE SAME AS SUNSPOTS
L. Svalgaard, P. H. Scherrer, and J. M. Wilcox Oct. 1978 10 p refs Presented at Workshop on Solar Rotation Catania, Sicily, Italy, 26-28 Sep. 1978
(Contract N00014-76-C-0207; NAS5-24420; Grant NGR-05-020-559; NSF ATM-77-20580)
(NASA-CR-157923; SU-IPR-766) Avail: NTIS HC A02/MF A01 CSCL 04A

The equatorial rotation rate of the photosphere was measured at effect data. It was found that scattered light has a large influence and must be taken into account properly. When this was done it was found that the rotation rate from Doppler shifts agreed very well with the rate found for sunspots. Short-term fluctuations in rotation rate (i.e. from day to day) were less than plus or minus 15 m/s and were thus within observational errors. G.Y.

N79-11597# Air Force Geophysics Lab., Hanscom AFB, Mass.
COMPILATION OF PAPERS PRESENTED BY THE SPACE PHYSICS DIVISION AT THE IONOSPHERIC EFFECTS SYMPOSIUM (IES 1978)
5 Apr. 1978 159 p refs Symp. held at Arlington, Va., 24-26 Jan. 1978 Sponsored by ONR
(AF Proj. 4643)
(AD-A057411; AFGL-TR-78-0080; AFGL-SR-212) Avail: NTIS HC A08/MF A01 CSCL 04/1

This is a compilation of seventeen (17) papers presented by the Space Physics Division at the 1978 Symposium on the Effect of the Ionosphere on Space and Terrestrial Systems. The symposium was jointly sponsored by the Naval Research Laboratory and the Office of Naval Research, January 24-26, 1978. The emphasis is on the occurrence of ionospheric irregularities and their effect on communication, radar and navigation systems. Author (GRA)

N79-11598# Southeastern Massachusetts Univ., North Dartmouth. Dept. of Electrical Engineering.
AN INTRODUCTION TO SEISMIC SIGNAL PROCESSING
C. H. Chen 8 Jun. 1978 16 p refs
(Grant AF-AFOSR-2951-76)
(AD-A056074; EE-78-3; AFOSR-78-1096TR) Avail: NTIS HC A02/MF A01 CSCL 08/11

This paper examines the fundamental problem areas and the available solutions in seismic signal processing. Topics considered include seismic signal modeling, spectral matching and the ARMA model, parameter estimation, homomorphic versus predictive deconvolution, Kalman filtering, and the measurement of the first arrival time. Author (GRA)

N79-11599# Physical Dynamics, Inc., Berkeley, Calif.
THE RELEVANCE OF BARIUM RELEASES TO PROBLEMS OF THE NUCLEAR ENVIRONMENT Topical Report, 1 Nov. 1975 - 31 Dec. 1977
J. B. Workman Dec. 1977 37 p
(Contract DNA001-76-C-0136)
(AD-A056249; AD-E300252) HC A03/MF A01 CSCL 04/1

Plasma enhancements in the ionosphere due to either barium releases or high altitude nuclear weapons develop fine scale structure by the gradient drift process. The effects of nuclear weapons on radio transmission must be modelled by approximate numerical models. Barium release data is extremely valuable in testing, modifying, and verifying such models. A discussion and an example of this activity will be treated in this paper.
Author (GRA)

N79-11600# Visidyne, Inc., Burlington, Mass.
FASCODE: FAST ATMOSPHERIC SIGNATURE CODE (SPECTRAL TRANSMITTANCE AND RADIANCE)
H. J. P. Smith, D. J. Dube, M. E. Gardner, S. A. Clough, and F. X. Kneizys 16 Jan. 1978 143 p refs
(Contract F19628-77-C-0041)
(AD-A057506; VI-409; AFGL-TR-78-0081; SR-2) Avail: NTIS HC A07/MF A01 CSCL 04/1

Using the HIRACC algorithm, a rapid running line-by-line transmittance code has been developed for a layered atmosphere. In addition, the atmospheric radiance is also calculated assuming local thermodynamic equilibrium. The Voigt line shape profile is used for the general case but both the Lorentz and Doppler profiles may be chosen for cases where the Voigt shape is not needed. GRA

N79-11601*# Chicago Univ., Ill. Dept. of Geophysical Sciences.
IDEAL SOLUTION OF AN INVERSE NORMAL MODE PROBLEM WITH FINITE SPECTRAL DATA
Victor Barcilon Jun. 1978 21 p refs
(Grant NsG-7274; Contract N00014-76-C-0034)
(NASA-CR-156302; AD-A056175) Avail: NTIS HC A02/MF A01 CSCL 08/7

The problem of reconstructing the density of a vibrating string given the first N eigenfrequencies for two vibrating configurations admits an infinite number of solutions. Among all such strings compatible with the truncated data set, the ideal string was defined to be that string for which a weighted average of the density is minimum. It was proven that this ideal string must have a finite number of degrees of freedom and hence, that it is made up by a finite number of concentrated point masses. By specializing the optimality criterion, it was shown that the Krein string is an ideal string. Author (GRA)

N79-11602# Denver Univ., Colo. Dept. of Physics.
SPECTRAL RADIOMETRIC MEASUREMENTS OF SUB-ARCTIC STRATOSPHERIC CONSTITUENTS
David G. Murcray, Aaron Goldman, John J. Kosters, Frank H. Murcray, and Walter J. Williams Apr. 1978 180 p refs
(Contract DAAD05-76-C-0740)
(AD-A057404; AD-E430043; ARBRL-CR-00372) Avail: NTIS HC A09/MF A01 CSCL 04/1

Constituent height profiles are derived for HNO3, O3, H2O, CF2Cl2, CFCl3 and two unidentified constituents from spectral radiance data observed on a balloon flight to 37.56 km on 29 April 1976 from Fairbanks, Alaska. Improvements in the band model techniques used are discussed and comparative results are shown. Spectral radiance data observed at selected altitudes and zenith angles are shown covering the spectral ranges of 8 to 13.6 micron and 18.8 to 27.6 micron. Tables of spectral radiance for selected spectral regions as a function of altitude are included. Author (GRA)

N79-11603# Texas Univ. at El Paso. Dept. of Electrical Engineering.
A COMPUTERIZED SYSTEM FOR THE REDUCTION OF MIDDLE ATMOSPHERIC ELECTRICAL CONDUCTIVITY DATA
Shyue-wun A. Shih and John D. Mitchell Jan. 1978 120 p refs
(Contract DAAD07-74-C-0263; DA Proj. 1L1-61102-B-53A)
(AD-A057367; SP14-77-UA-42;
ERADCOM/ASL-CR-78-0263-1) Avail: NTIS HC A06/MF A01 CSCL 04/1

A computerized system for the reduction of middle atmospheric electrical conductivity data obtained by either blunt probes or Gerdien condensers is developed in this report. This particular system uses the Digital Equipment Corporation (DEC) PDP 11/10 minicomputer interfaced with the DEC LPs11 Laboratory Peripheral System, DEC LA 36 writer II, Hewlett Packard HP 3960 Instrumentation Recorder and Tektronix 603 Storage Scope. Assembly Language and FORTRAN IV programs were developed under the DEC RT-11 operating system to perform data digitizing, acquisition, storage, display, processing and finally printing out the results. The conductivity values from the computerized data reduction system were found to be consistent with those obtained by manually scaling the demodulated data waveforms from a strip chart (the method previously used for reducing the data). In fact, the computerized system is believed to be a more accurate and reliable technique. The method was also observed to enhance the range of sensitivity, i.e., the altitude region over which data can be reduced from a particular experiment. Author (GRA)

N79-11604# Naval Postgraduate School, Monterey, Calif.
POWER SPECTRA OF GEOMAGNETIC FLUCTUATIONS BETWEEN 0.1 AND 10.0 Hz M.S. Thesis
John Michael Barry Jun. 1978 70 p refs
(AD-A057419) Avail: NTIS HC A04/MF A01 CSCL 08/14

An optically pumped Cesium vapor magnetometer was used to measure the temporal fluctuations of the total geomagnetic field at Monterey, California. Power spectra were obtained from these recordings for the frequency range 0.1-10 Hz. Measurements were made during the month of April 1978 with the Kp index varying from 0 to 8. The power spectra obtained displayed a characteristic -20 db/decade slope from 0.1-2.0 Hz and were essentially flat between 2.0-10 Hz. Measurement times were: local night (0000-0200), local morning (0800-1000) and local afternoon (1600-1800). Local morning exhibited the highest power density levels, exceeding the lowest power density levels (recorded during local night) by 10db at .1 Hz and 3db at 10 Hz. A comparison of a magnetically disturbed day (Fredricksburg a index of 7) with a magnetically quiet day (Fredricksburg a index of 3) showed that at the low frequency end of the spectrum (.1-.6 Hz) there was 10db more power on the disturbed day.Author (GRA)

N79-11605# Space Data Corp., Tempe, Ariz.
ROCKETBORNE OZONESONDE UTILIZING CHEMILUMINESCENCE TO MEASURE ATMOSPHERIC OZONE
Bruce Bollermann and Frank Hayo May 1978 71 p refs
(Contract DAAD07-75-C-0103)
(AD-A057423; SDC-TM-1427; ASL-CR-78-0103-1) Avail: NTIS HC A04/MF A01 CSCL 04/1

A chemiluminescent ozone sensor capable of measuring ozone concentration in the lower mesosphere and stratosphere has been developed. It is deployed with a small meteorological rocket (super Loki) of 5.4 cm diameter, at an altitude of 75 km and descends on a 2.1 meter STARUTE parachute. The sensor incorporates a new aerodynamic air sampling system which increases the flow of air over the detector to make possible the accurate measurement of ozone in the upper atmosphere. Calibration of the detector under simulated flight conditions as well as its dependence upon the flow rate are described. Test results obtained at White Sands Missile Range (32 N) are compared to those of other experiments. Author (GRA)

N79-11606# Illinois Univ. at Urbana-Champaign, Urbana. Dept. of Electrical Engineering.
BACKSCATTER IONOGRAM INVERSION BY RAY TRACING METHODS Final Technical Report, 1 Jan. - 31 Dec. 1977
R. E. Dubroff, N. N. Rao, and R. C. Yeh Griffiss AFB, N. Y. RADC Apr. 1978 107 p refs
(Contract F19628-77-C-0108; AF Proj. 2305)
(AD-A057274; UILU-ENG-78-2538; RADC-TR-78-86; TR-62) Avail: NTIS HC A06/MF A01

This report describes a computerized method for deducing ionospheric parameters from the measurement of backscatter leading edge ionograms. A number of test cases are presented to demonstrate this technique. The technique is documented through the use of a complete program listing, a sample output, and a set of flow charts for the major computer subroutines.
Author (GRA)

N79-11607# Gulf Universities Research Consortium, Bellaire, Tex.
POTENTIAL PRODUCIBILITY AND RECOVERY OF NATURAL GAS FROM GEOPRESSURED AQUIFERS OF THE CENOZOIC SEDIMENTS OF THE GULF COAST BASIN Final Report
Chapman Cronquist, J. P. Malott, N. H. Olsen, P. E. Purser, and F. W. Zimmerman 30 Oct. 1977 39 p refs
(Contract EX-76-C-01-2025)
(FE-2025-3) Avail: NTIS HC A03/MF A01

The geothermal geopressured gas resource of the Texas-Louisiana Gulf Coast area was studied. It appears to offer a reasonable chance of developing into an energy resource of considerable magnitude. It has the additional advantage that the gas and electricity can be fed into existing transportation systems at minimal investments, and it would supplement declining production from other sources as it was brought on stream. No fundamental technical problems are foreseen, and there appears to be no radically new technology development required. Four areas discussed are: the economics of individual reservoir size, extended well productivity, brine saturation of the natural gas, and an economical and environmentally satisfactory means of brine disposal. DOE

N79-11608# Utah Univ., Salt Lake City.
FINITE ELEMENT NUMERICAL STUDY OF ATMOSPHERIC TURBULENT MOTION AND DIFFUSION IN PLANETARY BOUNDARY LAYER
H. N. Lee 1978 11 p refs Presented at Conf. on Numerical Methods in Laminar and Turbulent Flow, Swansea, England, 18 Jul. 1978 Prepared in cooperation with the Brookhaven Natl. Library, Upton, N. Y.
(Contract EY-76-C-02-0016)
(BNL-24187; Conf-780712-1) Avail: NTIS HC A02/MF A01

A finite element model of turbulent motion and diffusion in the atmospheric planetary boundary layer is presented. In preliminary results the behavior of the planetary boundary layer agrees well with the available data. The proposed simple model is more economical and efficient than the complicated existing finite difference models developed by Deardorff and Shir. Due to the advantages of accurate representation of complex terrain with the finite element method, the model can be extended to treat horizontally inhomogeneous geometry. The dynamic formulation for the eddy coefficient is particularly attractive and can provide a viable alternative approach to study complicated atmospheric turbulent diffusion. DOE

N79-11609# California Univ., Livermore. Lawrence Livermore Lab.
IMPEDANCE CAMERA: A SYSTEM FOR DETERMINING THE SPATIAL VARIATION OF ELECTRICAL CONDUCTIVITY
R. J. Lytle and K. A. Dines 31 Jan. 1978 15 p refs
(Contract W-7405-eng-48)
(UCRL-52413) Avail: NTIS HC A02/MF A01

A data collection and data interpretation method is presented for predicting, from measurement made on the periphery of the core sample, the electrical conductivity distribution within core samples. This method uses an array of electrodes on the periphery to probe through the core sample. Surprisingly accurate detail can be seen in the estimated conductivity distribution. This method was demonstrated using synthetic examples modeled and analyzed on a computer. Extensions of the procedure may be useful in subsurface geophysical probing and remote probing methods using physical phenomena satisfying Laplace's equation. DOE

N79-11610# Danish Meteorological Inst., Copenhagen.
RUDE SKOV GEOPHYSICAL OBSERVATORY. MAGNETIC RESULTS, 1973
1977 41 p
(ISBN-87-7478-142-1) Avail: NTIS HC A03/MF A01

The results of the standard observations carried out at Rude Skov magnetic observatory during 1973 are presented. The measurements show hourly means of horizontal and vertical intensity and hourly means of magnetic declination. Diurnal extreme values and mean diurnal inequalities are also given.
ESA

N79-11611# Danish Meteorological Inst., Copenhagen.
RUDE SKOV GEOPHYSICAL OBSERVATORY. MAGNETIC RESULTS, 1974
1977 36 p
(ISBN-87-7478-144-8) Avail: NTIS HC A03/MF A01

The results of the standard observations carried out at the Rude Skov magnetic laboratory during 1974 are presented. The measurements show hourly means of horizontal and vertical intensity and hourly means of magnetic declination. Diurnal extreme values and mean diurnal inequalities are also given.
ESA

N79-11612# Danish Meteorological Inst., Copenhagen.
OCCURRENCES OF THE POLAR SLANT E CONDITION-SEC AT NARSSARSSUAQ, GODHAVN, THULE, 1975
I. S. Primdahl 1977 46 p refs
(ISBN-87-7478-139-1) Avail: NTIS HC A03/MF A01

Tables of slant E condition (SEC) occurrences scaled from the ionograms of Thule, Godhavn and Narssarssuaq (Greenland) for the year 1975 are presented. ESA

N79-11613# World Meteorological Organization, Geneva (Switzerland).
RADIATION REGIME OF INCLINED SURFACES
K. Y. Kondratyev 1977 95 p refs Sponsored by UNESCO
(WMO-467; TN-152; ISBN-92-63-10467-0) Avail: NTIS HC A05/MF A01; WMO, Geneva, Sw. Fr. 18

The importance of understanding the radiation regime of inclined surfaces in any attempt to make direct use of solar radiation as a source of energy is stressed. The approach suggested is to make use of available data on incoming direct, scattered and global radiation from stations which relate to horizontal surfaces and from this deduce the corresponding radiation component fluxes on inclined surfaces. ESA

N79-11614# Max-Planck-Institut fuer Kernphysik, Heidelberg (West Germany).
A REVIEW OF SELECTED TOPICS IN MAGNETOSPHERIC PHYSICS
Gregor E. Morfill Jul. 1977 200 p refs
Avail: NTIS HC A09/MF A01

The basic physical processes and recent progress in magnetospheric physics are reviewed. The topics are: magnetopause, plasmasphere, proton radiation belt, wave-particle interaction, electron radiation belt, wave excitation, aurorae, plasma mantle, plasma sheet, and magnetospheres other than terrestrial. For each, the basic theory and necessary topological considerations are detailed together with a presentation of the most recent experimental verifications. ESA

N79-11615# World Meteorological Organization, Geneva (Switzerland).
THE POLAR SUB-PROGRAMME Global Atmospheric Research Program
Mar. 1978 63 p refs Prepared jointly with ICSU, Rome
(GARP-Publ-19) Avail: NTIS HC A04/MF A01; WMO, Geneva Sw. Fr. 15

An overview of the polar subprogram of GARP and its scientific background are given. The Polar Experiment (POLEX) selected for FGGE together with its tasks and observing system are outlined.

Studies needed to assess the role of ice in climate dynamics are reviewed and the necessary techniques and modeling capabilities for climate-related experiments and monitoring within the polar subprogram are discussed. ESA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N79-11616 Pennsylvania State Univ., University Park.
BIFURCATION AND STABILITY IN A MODEL OF MOIST CONVECTION Ph.D. Thesis
Hampton Nelson Shirer 1978 230 p
Avail: Univ. Microfilms Order No. 7818791

A low-order spectral system representing moist convection in the absence of an externally imposed basic current is compared with analogous models in which a basic current is added. Both systems contain a wide variety of multiple solutions branching from one another as the environmental lapse rate is increased. The development of moist convection proceeds in the model via several distinct transitions of the flow regime to increasingly complex structures. Latent heating effects are approximated by assuming that all upward motion is moist adiabatic and all downward motion is dry adiabatic. The bottom of the domain occurs at cloud base. The variables are assumed to be cyclically continuous in the horizontal and vertical so that the orthogonal basis functions are trigonometric. Dissert. Abstr.

N79-11617# National Weather Service, Washington, D.C. Forecast Office.
LOW-LEVEL FRONTAL WIND SHEAR FORECAST TEST Summary Report, Nov. 1976 - Dec. 1977
Barry Richwien and Robert McLeod Apr. 1978 29 p refs
(AD-A058092; FAA-RD-77-184) Avail: NTIS HC A03/MF A01 CSCL 04/2

A summary report of low-level wind shear forecast tests for seven east-coast airports is provided. The purpose of the tests was to verify and if possible improve upon a technique which forecasts significant low-level wind shear when (1) a 10 F or greater surface temperature exists across a frontal zone and/or (2) a frontal zone has a surface movement speed of 30 knots or more. Forecasts in the form of Low-Level Wind Shear Advisories were prepared for 3 hour periods at the Weather Service Forecast Offices responsible for forecasting for the test airports involved. The advisories were subsequently relayed to pilots through FAA communications nets. The test results indicate that the forecast technique had limited success for warm frontal zones and that it is ineffective for cold frontal zones. Certain mesoscale features resulted in more pilot reports of low-level wind shear than for the synoptic frontal systems. Recommendations are made for the dissemination of shear advisories and for further investigations for improving low-level wind shear forecasts. Author

N79-11618# Naval Postgraduate School, Monterey, Calif.
IMPROVEMENTS IN TROPICAL CYCLONE MOTION PREDICTION BY INCORPORATING DMSP WIND DIRECTION ESTIMATES Ph.D. Thesis
Thomas Paul Walters Jun. 1978 73 p refs
(AD-A057288) Avail: NTIS HC A04/MF A01 CSCL 04/2

The wind fields used to initialize a coarse grid tropical cyclone motion prediction model were re-analyzed to include wind direction estimates based on Defense Meteorological Satellite Program (DMSP) photographs. An average of 20 upper-level direction estimates based on cirrus streaks and 17 low-level directions were available for the 32 cases considered. A control experiment with an analytic representation of a typhoon embedded in a basic current was used to test the effects of data distribution in the objective analysis scheme. Improved forecast accuracy occurred only when the incorporation of the DMSP wind direction estimates produced significant improvements in the wind fields in the immediate vicinity of the storm or in areas into which the storm eventually tracked. The incorporation of direction estimates located on the periphery of typhoons failed to re-direct the initial storm motion. GRA

N79-11619# California Univ., Livermore. Lawrence Livermore Lab.
VARIATIONAL WIND FIELD ADJUSTMENT OVER COMPLEX TERRAIN USING FINITE ELEMENT TECHNIQUES
D. R. Tuerpe, P. M. Gresho, and R. Sani 1978 5 p refs
Presented at the Conf. on the Sierra Nevada Meteorology, Lake Tahoe, Nev., 19-21 Jun. 1978; sponsored by USDA Forest Service
(Contract W-7405-ENG-48)
(UCRL-80531; Conf-780635-1) Avail: NTIS HC A02/MF A01

A finite difference computer code (MATHEW) for ensuring mass-consistency in wind fields has proven successful in providing input for ADPIC, a particle-in-cell advection-diffusion code used in pollution transport studies. An analog of MATHEW is described to be used in finite element advection-diffusion codes, finite element planetary boundary models, and for wind energy assessment studied in complex terrain. DOE

N79-11620# California Univ., Livermore. Lawrence Livermore Lab.
OAHU SURFACE WIND NETWORK: SUMMARY OF DATA AUGUST 1976 THROUGH JULY 1977
J. H. Shinn, J. J. Wilton, K. L. Hill, B. R. Clegg, and C. A. Sherman Apr. 1978 260 p refs
(Contract W-7405-eng-48)
(UCID-17798) Avail: NTIS HC A12/MF A01

A twenty station network of surface wind observations on Oahu, Hawaii, provides an extensive data base for characterization of mesoscale phenomena. These data are available in hourly averages of wind speed and direction beginning in August 1976, and are summarized here by means of an audit and statistics. The audit shows the amount of data available from each station, and the statistics provided are the average day (diurnal trend) and deviation, the monthly trends of daily means, the wind speed frequency curve, the Weibull distribution fit, and tabulated daily means. DOE

N79-11621# Sandia Labs., Albuquerque, N. Mex.
MARKOV CHAIN MODEL FOR CLOUD COVER SEQUENCES IN ALBUQUERQUE
F. G. Yost and E. A. Aronson Oct. 1977 13 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1430) Avail: NTIS HC A02/MF A01

An estimate of the transition probability matrix for day to day cloud cover statistics was shown to have a limiting property characteristic of a Markov chain of ergodic states. It was suggested that this transition probability matrix can be used to estimate conditional probabilities of cloud free lines of sight. DOE

N79-11622# Naval Postgraduate School, Monterey, Calif.
A STUDY OF THE VARIATION OF CONVECTIVE ACTIVITY ASSOCIATED WITH EASTERLY WAVES IN THE TROPICAL PACIFIC USING SATELLITE RADIATION DATA M.S. Thesis
Vincent Francis Looft Mar. 1978 45 p refs
(AD-A056329) Avail: NTIS HC A03/MF A01 CSCL 04/2

A composite study is carried out to deduce the structure of convective activity associated with easterly waves at five tropical Pacific radiosonde stations, Majuro, Ponape, Truk, Yap, and Koror, for the latter halves of 1974, 1975 and 1976. The data used include digitized satellite infrared radiation and albedo. The resultant structure, in general, shows maximum convective activity in or near the wave troughs. The distribution is similar to that of the humidity field composited previously. GRA

N79-11623# Royal Netherlands Meteorological Inst., De Bilt.
PRECIPITATION 1975
1976 125 p In DUTCH and ENGLISH
(KNMI-117) Avail: NTIS HC A06/MF A01; Roy. Neth. Meteorol. Inst. Dfl. 10

Monthly tables are presented containing the daily amount of precipitation together with the amount per decade and per month at all stations of the Royal Netherlands Meteorological

Institute where measurements were made in 1975. Average values of the amount of precipitation are included for stations at which measurements were made during the period 1931 to 1960. Total annual amounts are tabulated separately. ESA

N79-11624# Danish Meteorological Inst., Copenhagen.
DANISH EXPERIENCES AND PLANS FOR ESTABLISHMENT OF ARCTIC WEATHER OBSERVING STATIONS
Joergen Taagholt 1977 12 p refs Presented at the Intern. Comm. on Polar Meteorol. Symp. at the IAGA/IAMAP Joint Assembly, Seattle, Sept. 1977
Avail: NTIS HC A02/MF A01

Following a brief description of meteorological conditions in Greenland the requirements and technical installation of automatic weather stations there are summarized. The meteorological parameters to be recorded are listed and factors which may affect the operation of the stations are noted. ESA

N79-11625# World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH: GLOBAL OBSERVING SYSTEM - SATELLITE SUB-SYSTEM. INFORMATION ON METEOROLOGICAL SATELLITE PROGRAMS OPERATED BY MEMBERS AND ORGANIZATIONS
Dec. 1977 26 p
(WMO-411-Suppl-5) Avail: NTIS HC A03/MF A01; WMO, Geneva

General information concerning the operating country, orbit, data collection, sensors, data transmission and other technical characteristics of meteorological satellites to be used in the Global Observing System is given. The particular satellites included are the European Meteosat satellite, the USSR Meteor operational meteorological satellite, the USSR Meteor-2 improved meteorological operational and the USSR Meteor experimental meteorological satellite. ESA

N79-11626# World Meteorological Organization, Geneva (Switzerland).
WORLD WEATHER WATCH: CONSOLIDATED REPORT ON THE VOLUNTARY ASSISTANCE PROGRAM INCLUDING PROJECTS APPROVED FOR CIRCULATION IN 1977
Jan. 1978 397 p
(WMO-501; ISBN-92-63-10501-4) Avail: NTIS HC A17/MF A01; WMO, Geneva

General remarks on the status of the overall Voluntary Assistance Program (VAP) are followed by guidelines for use in the implementation of World Weather Watch projects through VAP. Equipment required to implement VAP projects approved for 1977 is listed as are members' contributions to VAP. The status of the implementation of VAP projects on 31 December 1977 is given together with full lists of individual VAP projects approved for circulation in 1977 and projects approved for circulation between 1968 and 1967 which have since been modified. ESA

N79-11627# Societe Francaise d'Etudes et de Realisations d'Equipments Aeronautiques (Sofreavia), Paris (France).
STUDY OF THE SITUATION AND THE NEEDS IN AFRICA RELATING TO METEOROLOGICAL TELECOMMUNICATIONS
G. A. Delorme and J. M. Rainer ESA Mar. 1978 104 p
(Contract ESA-3530/78-F-FC(SC))
(ESA-CR(P)-1091) Avail: NTIS HC A06/MF A01

The organization of meteorological telecommunications at global and African regional level is recalled and the situation concerning the operation of the African regional and national networks with reference to WMO recommendations is reviewed. Operation of the various components of the regional plan is examined: point-to-point circuits, radio broadcasts, networks for assembly of synoptical, and ship and aircraft data. The shortcomings and deficiencies in the use of equipment and with the operation of the system are noted and prospects for improvement are listed. The advantages of circuits using underwater cables and communication satellites over HF radio circuits are stressed, as is the adaptation to the needs of the national SSB (single sideband)/ HF networks. In the case of a developing continent, utilization of space systems for meteorological telecommunications, which has already started with WEFAX dissemination and the collection of data, seems to have a real future. Taking into account the reliability of service by satellite - and apart from the transmission of data from the National Meteorological Center to the Regional Telecommunication Hub (RTH) which is akin to collection - all the other telecommunication functions required for meteorology can be carried out through broadcasts. Proposals for a satellite telecommunications system for meteorological needs are made. Author (ESA)

N79-11628# National Weather Service, Silver Spring, Md. Systems Development Office.
PROGRAMS AND ACCOMPLISHMENTS: SYSTEMS DEVELOPMENT OFFICE, FISCAL YEAR 1977 Annual Report
May 1978 60 p
(PB-284527/9; NOAA-78062902) Avail: NTIS HC A04/MF A01 CSCL 04B

Significant achievements in improving National Weather Service operations, products, and services are reported. Emphasis is focused on severe storms, aviation automatic weather observation, next generation upper air systems, and automatic meteorological observing platforms. GRA

N79-11629# Wisconsin Univ., Madison. Dept. of Meteorology.
ISENTROPIC NUMERICAL MODELS: RESULTS ON MODEL DEVELOPMENT FOR ZONALLY AVERAGED AND SECONDARY CIRCULATIONS Progress Report, 1971 - 1977
Robert L. Gall, Robert G. Gallimore, Jr., Donald R. Johnson, Robert E. Schlesinger, and Louis W. Uccellini Nov. 1977 300 p refs
(Grants NSF ATM-75-23223; NSF-GA-30978)
(PB-283480/2) Avail: NTIS HC A13/MF A01 CSCL 04B

Results of model development and numerical simulation of atmospheric circulation within isentropic coordinates are reported. Numerical simulations of the zonally averaged circulation and of a jet streak propagating in a channel are presented from three model developments. Eliassen's (1951) perspective of the forcing of a vortex is applied to the zonally averaged circulation in a theoretical paper and used in the interpretation of the forcing of the mass circulation. Primary objectives of the jet streak experiments are to test methods for incorporation of latent heat release and to couple prediction in the free troposphere by an isentropic model with prediction in the planetary boundary layer expressed in sigma coordinates. GRA

N79-11630# National Environmental Satellite Service, Washington, D. C.
SATELLITE DATA SET FOR SOLAR INCOMING RADIATION STUDIES
J. Dan Tarpley, Stanley R. Schneider, J. Emmett Bragg, and Marshall P. Waters May 1978 45 p refs
(PB-284740/8; NOAA-TM-NESS-96; NOAA-78062809) Avail: NTIS HC A03/MF A01 CSCL 04A

The National Environmental Satellite Service (NESS) collected and processed Geostationary Operational Environmental Satellite (GOES) data in the summer of 1977 as part of a joint experiment with the Great Plains Agricultural Council (GPC) to determine if incoming solar radiation could be inferred from satellite data. The satellite data collection effort entailed the calculation of cloud amount, cloud brightness, mean target brightness, precipitable water, and surface pressure for 50-km areas over the Great Plains. Sixty-three days of satellite data were collected. A coincident set of pyranometer data was obtained by the GPC. GRA

N79-11631# National Cancer Inst., Bethesda, Md. Div. of Cancer Cause and Prevention.
BIOASSAY OF 4-CHLORO-O-PHENYLENEDIAMINE FOR POSSIBLE CARCINOGENICITY, CAS NO. 95-83-0
1978 101 p refs
(PB-283362/2; NCI-CG-TR-63; DHEW/PUB/NIH-78-1313)
Avail: NTIS HC A06/MF A01 CSCL 06T

A bioassay for possible carcinogenicity of technical-grade 4-chloro-o-phenylenediamine was conducted using Fischer 344 rats and B6C3F1 mice. The 4-chloro-o-phenylenediamine was administered in the feed, at either of two concentrations, to groups of 49 or 50 male and 50 female animals of each

species. The chemical was administered for 78 weeks. Fifty animals of each species and sex were placed on test as controls. In male and female rats, a significantly increased incidence of neoplasms of the urinary bladder occurred in the chemically treated groups. A significantly increased incidence of hepatocellular carcinomas occurred in chemically treated male and female mice. Evaluation of the results of the bioassay indicates that 4-chloro-o- phenylenediamine is a urinary bladder carcinogen in male and female Fischer 344 rats and a hepatocarcinogen in male and female B6C3F1 mice. Author

N79-11632# National Technical Information Service, Springfield, Va.
CLEAR AIR TURBULENCE. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - Jul. 1978
Guy E. Habercom, Jr. Sep. 1978 295 p Supersedes NTIS/PS-77/0857; NTIS/PS-76/0705; NTIS/PS-75/761; NTIS/PS-75/008
(NTIS/PS-78/0938/7; NTIS/PS-77/0857; NTIS/PS-76/0705; NTIS/PS-75/761; NTIS/PS-75/008) Avail: NTIS HC $28.00/MF $28.00 CSCL 04B

Clear air turbulence and its relationship to air transportation is documented in the cited research reports. Its meteorological occurrences, its detection, and aircraft encounters with the phenomena are investigated. This bibliography contains 288 abstracts. GRA

N79-11633# Minnesota Legislature Science and Technology Project, St. Paul.
WEATHER MODIFICATION INFORMATION FOR THE MINNESOTA LEGISLATURE
Sep. 1977 138 p refs
(Grant NSF ISP-76-02379)
(PB-283999/1; NSF/RA-770561) Avail: NTIS HC A07/MF A01 CSCL 04B

The information presented was made available to the members of the Minnesota State Legislature in order to provide the legislators with sufficient data to help each of them make a more informed decision on the need for weather modification legislation for the state. Included is the following: (1) the Public Service Legislative Study relating to the technical aspects of weather modification; (2) the Public Service Legislative Study relating to the legal issues of weather information; (3) a summary of weather modification information; (4) a summary of legislative activity with regard to weather modification legislation in the 70th Minnesota Legislature; and (5) a glossary of legal and technical terms related to weather modification. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N79-11634 Cornell Univ., Ithaca, N. Y.
THE MECHANICAL BEHAVIOR OF THE OCEANIC LITHOSPHERE NEAR SUBDUCTION ZONES Ph.D. Thesis
John Gerrit Caldwell 1978 161 p
Avail: Univ. Microfilms Order No. 7817824

Eighty-nine corrected bathymetric profiles, collected from seven island arc regions, were compared with theoretical deflection curves generated from thin elastic plate theory and thin elastic-perfectly plastic plate theory. The wavelength of the outer rise specifies the effective elastic thickness (EET) of the lithosphere, and the steepness of the outer trench slope, with the EET as a constraint, primarily specifies the magnitude of horizontal axial forces acting on the lithosphere being subducted. The good agreement found to exist between the observed profiles and the theoretical deflection curves suggests that the oceanic lithosphere is under 2 to 6 kb compression along the Aleutian trench, the Kuril trench, the Philippine trench, and part of the Middle American trench. No horizontal stresses are required to match profiles across the Nankai trough, the Tonga trench, and the Mariana trench. Dissert. Abstr.

N79-11635 Wisconsin Univ. - Madison.
NUMERICAL MODEL STUDY OF SUBDUCTION AND THE DEFORMATION OF THE OCEANIC LITHOSPHERE Ph.D. Thesis
Thomas Mitchell Tharp 1978 217 p
Avail: Univ. Microfilms Order No. 7814289

The oceanic lithosphere adjacent to a subduction zone is modeled as an elastic beam with variable flexural rigidity or as a viscoelastic beam incorporating Mohr-Coulomb and tensile failure. The viscous flow equations are vacancy and dislocation related and include terms which are temperature and pressure-dependent. This introduces a depth dependence which is included in the numerical model. The system of equations to be satisfied for the beam includes those equations required for the application of classical thin beam theory, the differential equation for beams, and the constitutive equations for the lithosphere. This system of equations is approximately satisfied by an interative numerical process. Valid models are those causing deflections which closely match known trench bathymetry. The overall subduction system is also studied, using a two-dimensional finite element model to investigate both short-term and long-term stress and displacement changes, with a variety of driving mechanisms and material property configurations. Dissert. Abstr.

N79-11636# Naval Postgraduate School, Monterey, Calif.
SALINITY EFFECTS IN AN OCEAN MIXED-LAYER MODEL M.S. Thesis
Richard Alan Paulus Mar. 1978 78 p
(AD-A056326) Avail: NTIS HC A05/MF A01 CSCL 08/10

A one-dimensional mixed-layer model of ocean thermal structure (Camp, 1976) was first modified to determine the effects of a salinity profile on density structure and secondly to observe the added effects of surface salinity flux. The model was tested in August and November-December 1974 with (1) hydrocast data at Ocean Stations HOTEL and PAPA and (2) salinity profiles statistically derived from historical data for six ocean stations and adjusted to correspond to an observed BT. Inclusion of salinity structure did not significantly affect mixed-layer depth or temperature predictions during the summer period. During the winter period, salinity structure tended to inhibit deepening yielding a slightly warmer, shallower mixed layer. Surface salinity flux altered significantly the thickness of the isothermal layer, with decreases in thickness during precipitation E-P=0 and a tendency for increased thickness during some periods of net downward heat flux when E-P=0. Author (GRA)

N79-11637# ORI, Inc., Silver Spring, Md.
MODEL RESULTS OF THE EFFECTS OF INTERNAL WAVES ON ACOUSTIC PROPAGATION Final Report
E. Moses, W. Galati, and W. Nicholas 3 Aug. 1978 92 p refs
(Contract N00014-76-C-0479; NR Proj. 274-253)
(AD-A057333; ORI-TR-1295) Avail: NTIS HC A05/MF A01 CSCL 08/3

A model has been developed which simulates time variations in Acoustic transmission induced by internal wave activity in the ocean. The model produces explicit sample time series of acoustic transmission parameters. An explicit objective of the work was to provide a mechanism for investigating how such fluctuations affect low frequency sonar performance. The model parameterizes the internal wave field according to a power spectrum proposed by Garrett and Mink, and unperturbed acoustic transmission through use of ray trace techniques. The interaction between the two considers the effect on the phase of individual ray paths, and consequent fluctuations in the multipath sum. Both the ray trace characteristics and some parameters of the internal wave field depend on environmental conditions, so that the model can investigate sensitivity of results to geographic location and season. Sample model results show a strong increase in fluctuation rates with increasing acoustic frequency, a fluctuation magnitude (one standard deviation) of 5 to 6 db except, perhaps, at short range, and no strong dependence on geographic location. One direct comparison of model results with experimental fluctuation data was made, and the results are considered very satisfactory. Author (GRA)

N79-11638# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.
OCEAN MAGNETICS. 1: FUNDAMENTAL SURVEY AND ESTIMATES OF INDUCTION PHENOMENA

J. F. Bird and H. W. Ko Oct. 1977 94 p refs
(Contract N00017-72-C-4401)
(AD-A057396; ARL/JHU/TG-1315A) Avail: NTIS HC A05/MF A01 CSCL 08/3

Hydromagnetic phenomena are induced in the ocean environment by motions of the electrically conducting seawater across ambient fields. The present report is intended to survey and estimate possible effects from a fundamental theoretic standpoint. The ocean motions considered include both those of natural origin and those associated with moving ocean vehicles. The ambient magnetic field is that due to the earth, plus that due to the vehicle if it is magnetizable. These various motions and fields produce a broad multitude of ocean magnetic (OM) phenomena. The manifold of OM effects is surveyed theoretically, and from basic physical principles simple numerical estimators for the effects was derived. The potentially more significant include several pure induction types (nonpropagating) and several pseudowave types (OM induction effects propagated by mechanical waves). Detailed analyses of these OM phenomena will be presented in subsequent reports. Author (GRA)

N79-11639# Naval Research Lab., Washington, D. C.
GULF STREAM GROUND TRUTH PROJECT. RESULTS OF NRL AIRBORNE SENSORS Final Report
C. R. McClain, D. T. Chen, and D. L. Hammond Jun. 1978 101 p
(AD-A057420; NRL-MR-3779) Avail: NTIS HC A06/MF A01 CSCL 08/3

Results of ocean surface measurements by NRL active and passive sensors are summarized. The data set was collected during three flights over the Gulf Stream in the Spring of 1976 and coincided with in situ measurements taken from an oceanographic research vessel. The sensors were the NRL high flight radar, NRL wind-wave radar, a laser profilometer and a precision radiation thermometer. The quantities derived include sea state, ocean wave frequency spectra, surface wind speed and sea surface temperature. The remote determinations are found to agree very well with other data sources. In addition, experimental and theoretical results regarding the effects of ocean wave angular spreading on airborne profilometer determinations of wave frequency spectra are included as well as a detailed description of the data analysis algorithm. The spectral distortion is not severe for track angles within 15 degrees of the wind vector. These indicate that airborne profilometer data is still useful for wind-wave generation studies as long as close attention is given to the track angle relative to the dominate surface wave direction. Also, the proposition of using spectra from various track angles to infer the angular spreading function does not appear promising because the spectra do not show a substantial enough variation with the angular spreading function.
Author (GRA)

N79-11640# North Carolina State Univ., Raleigh. Center for Marine and Coastal Studies.
CONTINENTAL MARGIN ATMOSPHERIC CLIMATOLOGY AND SEA LEVEL: HISTORICAL SETTING 1974 - 1975
L. J. Pietrafesa, R. DAmato, C. Gabriel, and R. J. Sawyer, Jr. Feb. 1978 300 p refs
(Contract EY-76-S-09-0902)
(SRO-902-8) Avail: NTIS HC A13/MF A01

Atmospheric wind and pressure were examined and correlated with coastal sea level changes at various coastal stations along the South Atlantic Bight. Graphs of temperature, pressure, wind velocity components, and wind stress components are presented for the Georgia and Carolina coasts. Sea level measurements are included along with graphs of kinetic energy density spectra. DOE

N79-11641# Brookhaven National Lab., Upton, N. Y.
ERDA'S OCEANOGRAPHIC PROGRAM FOR THE MID-ATLANTIC COASTAL REGION
F. W. Barvenik, ed. 1977 137 p refs Presented at Workshop on Mid-Atlantic Coastal Oceanographic Res., Upton, N. Y., 3-7 Jan. 1977
(Contract EY-76-C-02-0016)
(BNL-24016) Avail: NTIS HC A07/MF A01

The impact of natural resources development on the Mid-Atlantic continental shelf itself or within the region and the location of energy facilities upon or adjacent to the shelf are discussed as part of an ERDA program to optimize energy development while minimizing deleterious environmental effects. The principal stresses and how they may be transferred in the ecosystem or to man are assessed. Contractor capabilities and research facilities are reviewed and the potential for multi-group or multi-agency research coordination is asserted. The appendix contains research summaries from the present contractors. DOE

N79-11642# Danish Meteorological Inst., Copenhagen.
OCEANOGRAPHICAL OBSERVATIONS FROM DANISH LIGHT-VESSELS AND COASTAL STATIONS, 1975
1977 112 p In DANISH and ENGLISH
(ISBN-87-7478-147-2) Avail: NTIS HC A06/MF A01

Observations from Danish light-ships for 1975 are presented. Measurements include current direction and velocity, water and surface temperature and salinity and observations of the direction, height and period of waves together with synoptic meteorological observations. ESA

N79-11643# Deutsches Hydrographisches Institut, Hamburg (West Germany).
RESEARCH SHIP METEOR OF THE GERMAN RESEARCH SOCIETY AND THE GERMAN HYDROGRAPHICAL INSTITUTE. VOYAGE NO. 44 (4 JANUARY - 10 MARCH 1977). 'UPWELLING' 1977: REPORTS ON THE SCIENTIFIC RESEARCH [FORSCHUNGSSCHIFF METEOR DER DEUTSCHEN FORSCHUNGSGEMEINSCHAFT UND DES DEUTSCHEN HYDROGRAPHISCHEN INSTITUTS. FAHRT NR. 44 (4. JANUAR - 10. MAERZ 1977. AUFTRIEB 77: BERICHTE UEBER DIE WISSENSCHAFTLICHEN ARBEITEN]
1978 71 p In GERMAN and ENGLISH Report contains color illustrations
Avail: NTIS HC A04/MF A01

Meteor cruise 44 (Auftrieb 77) was devoted to further investigations of upwelling off northwest Africa as a contribution to the international CINECA Program (Cooperative Investigation of the Northern Part of the Eastern Central Atlantic). The major part of the investigations were concentrated on the continental shelf area between 19 deg N (south of Cap Timiris) and 17 deg N. Although the areas influenced by upwelling do not cover even 0.1% of the total area of the world oceans, an important percentage of the world fish catches is originated there. A high content of nutrients in the euphotic layer, important biological production, and abundant stocks of fish in these areas are results of upwelling, the rising of deep water to the surface. The experiment AUFTRIEB 77 was aimed at improving both qualitatively and quantitatively model conceptions of the ecosystem in the coastal area of upwelling, especially off northwest Africa. The wind that causes upwelling was measured for one month. At the same time currents, temperature, and salinity were registered. The concentration of nutrients, of chlorophyll and oxygen in water was studied. The high contents of nutrients in the near surface layer causes the well known high productivity in the upwelling area. Communities and living conditions of plankton were studied. Special experiments were expected to give insight into the growth requirements of plankton and into the feeding relations between phyto- and zoo-plankton. The distribution in space of abundant fish larvae was studied. A considerable part of the biological work was concentrated on the flora and fauna at the bottom of the sea. Besides photos taken at the sea floor, samples were taken systematically comprising the entire food chain, from micro-organisms up to fishes. Author (ESA)

N79-11644# Woods Hole Oceanographic Institution, Mass.
POLYMODE XBT SURVEY BY THE SOVIET RESEARCH VESSEL VICTOR BUGAEV, 10-21 JULY 1977
Mar. 1978 14 p
(Grant NSF OCE-77-01026)
(PB-283316/8; XBT/TR-78/1; NSF/IDOE-78/64) Avail: NTIS HC A02/MF A01 CSCL 08J

Data collected during July 1977 by the Soviet research vessel Victor Bugaev are presented. An XBT survey was made of a circular region roughly 500 km in diameter centered at 29 degrees N, 70 degrees W. This region, frequently referred to as the 'Polymode area', is the site of repeated XBT and CTD

surveys along with current measurements and neutrally buoyant float observations as parts of the joint US/USSR POLYMODE Program. Track charts and various presentations of the thermal structure in vertical and/or plan view, depending on the pattern of the data, are included along with a brief description of the major eddy features. GRA

N79-11645# Virginia Inst. of Marine Science, Gloucester Point. Dept. of Applied Marine Science and Ocean Engineering.
VIRGINIAN SEA WAVE CLIMATE MODEL PUBLICATION SERIES NO. 3. STORM SURGE-IN-WAVE INTERACTION MODEL: LITERATURE REVIEW OF SURGE MODELS, DESCRIPTION, AND RESULTS OF VIRGINIAN SEA MODEL
Michael J. Carron and Victor Goldsmith Jun. 1978 115 p refs
(Grant NOAA-04-6-158-4407)
(PB-284733/3; VIMS-SRAMSOE-110; NOAA-78062801) Avail: NTIS HC A06/MF A01 CSCL 08C

The effect of storm surge on wave refraction patterns along 320 km of shoreline in the Virginian Sea (Mid-Atlantic Shelf) was investigated using an analytical model. Two types of storm surge patterns are used to alter the ocean surface of the Virginian Sea Wave Climate Model. The two sets of wave ray diagrams, and shoreline wave energy and wave height distribution are compared. The characteristics of the general wave response models are summarized, using similar wave input parameters. GRA

N79-11646# North Carolina State Univ. at Raleigh Center for Marine and Coastal Studies.
NUMERICAL FLOW MODEL FOR AN ATLANTIC COAST BARRIER ISLAND TIDAL INLET
T. C. Gopalakrishnan and J. L. Machemehl Apr. 1978 64 p refs
(Grant NOAA-04-6-158-44054)
(PB-284732/5; UNC-SG-78-02; CMCS-78-1; NOAA-78062813) Avail: NTIS HC A04/MF A01 CSCL 08C

A numerical model for computation of flow in inlets with junction is developed. The Galerkin technique is coupled with a finite element analysis in the flow model. The vertically integrated equations of momentum and mass conservation are used with appropriate boundary and initial conditions. The junction conditions are introduced by the time rates of change of energy and mass flux at the junction. A double sweep approach is used in solving for the dynamics of flow. A parabolic shape function is adopted in the model to satisfy the requirement of linear independence. The numerical flow model is verified with field data for Carolina Beach inlet, North Carolina. The tidal fluctuations in the inlet gorge and tidal velocities in the Atlantic Intracoastal Waterway were used as initial and boundary conditions respectively. The tidal velocities in the inlet gorge and tidal fluctuations in the Atlantic Intracoastal Waterway were computed with the numerical simulation flow model and compared with field data. GRA

N79-11647# National Marine Fisheries Service, Seattle, Wash.
SEA SURFACE TEMPERATURE DISTRIBUTIONS OBTAINED OFF SAN DIEGO, CALIFORNIA, USING AN AIRBORNE INFRARED RADIOMETER
James L. Squire (Natl. Marine Fisheries Service, La Jolla, Calif.) Mar. 1978 38 p refs
(PB-284736/6; NOAA-TR-NMFS-SSRF-720; NOAA-78062601) Avail: NTIS HC A03/MF A01 CSCL 08T

Sea surface temperature surveys were conducted weekly off San Diego, Calif., using an airborne infrared radiometer during the months of April through October 1972-74. A total of 900 surveys were made over the 320 mile flight track. The analog chart record of temperature was keyed to a ground truth temperature measurement and read to determine 1 min average temperatures which were plotted on the flight track and 1F(0.56C) isotherms were contoured from the data. The 1972-74 survey temperatures taken over the ground truth calibration site were compared with a time series of temperature observations taken during the same month from 1963 to 1968. GRA

N79-11648# Inter-American Tropical Tuna Commission, La Jolla, Calif.
COASTAL ZONE AND OPEN OCEAN OBSERVATIONS FROM NOAA SATELLITE VERY HIGH RESOLUTION RADIOMETERS Final Report
Merritt R. Stevenson and Robert G. Kirkham Dec. 1977 99 p refs
(Contract NOAA-03-7-208-35236)
(PB-284445/4; NOAA-78070512) Avail: NTIS HC A05/MF A01 CSCL 08J

The utility of very high resolution radiometers, aboard NOAA-5, for measuring sea surface temperature (SST) is considered. The feasibility of deriving reliable SST's from the thermal infrared data sensed by these instruments, for both coastal zone and open ocean regions during CY 1978 is stressed. The investigations include the analysis of very high resolution radiometer infrared (VHRRIR) digital data fields from eight particular NOAA series satellite orbits. The derived SST fields are contoured both by grayscaling, and by the more conventional streamline format, and estimates are also made of absolute derived SST's. GRA

N79-11649# Inter-American Tropical Tuna Commission, La Jolla, Calif.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS. DATA REPORT 46: PHYSICAL/NUTRIENT MEASUREMENTS, JOINT-2, 5-30 MARCH 1977
Merritt R. Stevenson and Robert Wagner Mar. 1978 201 p refs
(Grant NSF OCE-76-82834)
(PB-283333/3; NSF/IDOE/CUEA/DR-46; NSF/IDOE-78-65) Avail: NTIS HC A10/MF A01 CSCL 08J

Cruise CALOC 77 of the R/V Cayuse involved the conducting of drogue experiments and supporting STD hydrography as part of a series of integrated experiments in and around upwelling plumes or fronts off the southern coast of Peru. Nine hydrographic stations were occupied. At each station, an STD cast was made almost to the bottom to obtain vertical profiles of temperature and salinity. In addition, a bottle cast using NIO bottles was used to obtain water samples at discrete depths for nutrient analysis. GRA

N79-11650# Florida State Univ., Tallahassee. Dept. of Meteorology.
COASTAL UPWELLING ECOSYSTEMS ANALYSIS. TECHNICAL REPORT 41: A STUDY OF THE LOW-LEVEL MESOSCALE WINDS OBSERVED OFF THE PERUVIAN COAST DURING MARCH AND APRIL 1976 M.S. Thesis
Andrew Irvine Watson Apr. 1978 135 p refs
(Grants NSF OCE-75-06469A02; NSF OCE-76-82831A01)
(PB-283335/8; FSU-CUEA-MET-78-1; NSF/IDOE/CUEA/TR-41; NSF/IDOE-78-67) Avail: NTIS HC A07/MF A01 CSCL 08T

The low-level mesoscale wind field over the Peruvian coastal upwelling region was investigated. Horizontal data were recorded primarily at one level, 500 ft (152 m). Vertical representations of the atmosphere were provided by soundings along a line normal to the coast. Individual flight case studies presenting examples of weak, strong, and transition wind regimes were examined. Comparisons were made between profiles of the alongshore wind component and sea surface temperatures. Profiles of sea surface temperature between the mouth of the Rio Ica and the offshore buoy confirm the effect of the wind on coastal upwelling. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N79-11651*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
US EXPERIMENTS FLOWN ON THE SOVIET SATELLITE COSMOS 782 Final Reports
Susan N. Rosenzweig (Northrup Serv., Inc., Anaheim, Calif.) and Kenneth A. Souza Sep. 1978 416 p refs
(NASA-TM-78525; A-7612) Avail: NTIS HC A18/MF A01 CSCL 06B

Experiment hardware, preflight activities, on-orbit activities, and postflight activities relevant to the 11 U.S. experiments on

board the Soviet spacecraft ard described. For individual titles, see N79-11652 through N79-11670.

N79-11652*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
US EXPERIMENTS FLOWN ON COSMOS 782 Final Report
Wayne H. Howard and Kenneth A. Souza *In its* US Expt. Flown on the Soviet Satellite COSMOS 782 Sep. 1978 p 1-32 (For primary document see N79-11651 02-51)
Avail: NTIS HC A18/MF A01 CSCL 06B

The Cosmos 782 mission is summarized. Seven countries participated with experiments in 15 categories. The experiments, in general, concentrated on comparing the effects of weightlessness versus artificial gravity on genetics, growth, development, and aging. The 11 U.S. experiments used rats, fruit flies, carrot tissue slices, embryoids, fish eggs, and radiation dosimeters. Lists of participating countries, experiments, and mission operations are presented. The U.S. experiment hardware, preflight activities, and postflight activities are briefly described. S.B.S.

N79-11653*# Colorado State Univ., Fort Collins. Dept. of Botany and Plant Pathology.
RESPONSE OF CROWN GALL TISSUE TO THE SPACE ENVIRONMENT: RESIDUAL CARBOHYDRATES IN SUPPORTING TISSUE Final Report
John E. Hendrix and Bonnie L. Baker *In* NASA. Ames Res. Center US Expt. Flown on the Soviet Satellite COSMOS 782 Sep. 1978 p 33-44 refs (For primary document see N79-11651 02-51)
Avail: NTIS HC A18/MF A01 CSCL 06C

Slices of carrot crown gall supporting tissue were used to study the effect of weightlessness on respiration. Amounts of amylose, sucrose, and glucose in gall flight discs from COSMOS 728 and in comparable control discs were determined and compared. Both amylose and sucrose decreased in concentration while in the flight environment; however, there was a marked increase in the concentration of glucose. There was no detectable difference between the tissue subjected to weightlessness compared to the tissue subjected to the g environment. Results show that the overriding environmental parameter was water stress which induced the tissue to increase the number of small molecules so that water could be retained by the tissue. S.B.S.

N79-11654*# Colorado State Univ., Fort Collins. Dept. of Botany and Plant Pathology.
RESPONSES OF CROWN GALL TISSUE TO THE SPACE ENVIRONMENT: TUMOR DEVELOPMENT AND ANATOMY Final Report
Ralph Baker, Bonnie L. Baker, and Lee Elliot *In* NASA. Ames Res. Center US Expt. Flown on the Soviet Satellite COSMOS 782 Sep. 1978 p 45-57 refs (For primary document see N79-11651 02-51)
Avail: NTIS HC A18/MF A01 CSCL 06C

Tumor development from bacterial innoculation in slices of carrot crown gall supporting tissue was used to study the effects of weightlessness on metabolism. Carrot discs from COSMOS 782 were compared to earth-based controls. Statistically significant larger crown gall tumors developed on carrot disks on a centrifuge exposed to the space environment than those in weightlessness. This is the opposite reaction predicted from previous Earth-based gravity compensated experiments. In contrast, an increase in radius of the meristematic rings of growth centers in these teratoma type galls was observed for tissues generated in weightless conditions. S.B.S.

N79-11655*# Colorado State Univ., Fort Collins. Dept. of Anatomy.
RESPONSES OF CROWN GALL TISSUE TO THE SPACE ENVIRONMENT: GLUTAMINE SYNTHETASE ACTIVITY Final Report
Stephen J. Kleinschuster and Kathleen Mahon *In* NASA. Ames Res. Center US Expt. Flown on the Soviet Satellite COSMOS 782 Sep. 1978 p 58-63 refs (For primary document see N79-11651 02-51)
Avail: NTIS HC A18/MF A01 CSCL 06C

Carrot crown gall tumors exposed to weightlessness on COSMOS 782, null-gravity experimentation, and appropriate controls were analyzed for the specific activity of glutamine synthetase following such treatment. Results show that the specific activities of compensated or weightless material are, in general, lower than the various controls. The data also indicates that null-gravity and true weightlessness, with respect to glutamine synthetase activity, are largely comparable. S.B.S.

N79-11656*# Colorado State Univ., Fort Collins. Dept. of Botany and Plant Pathology.
RESPONSES TO CROWN GALL TISSUE TO THE SPACE ENVIRONMENT: ISOZYME PATTERNS Final Report
Penelope Hanchey *In* NASA. Ames Res. Center US Expt. Flown on the Soviet Satellite COSMOS 782 Sep. 1978 p 64-70 refs (For primary document see N79-11651 02-51)
Avail: NTIS HC A18/MF A01 CSCL 06C

The growth of carrot crown gall tumor tissue was used to study the effects of gravity on isozyme activity. Peroxidases zymograms of gravity-compensated tissue were compared with those of tissue actually flown at zero gravity on the COSMOS 782 satellite. The patterns obtained, while not identical, were distinct from control tumors grown at one g on the spacecraft or kept stationary in the laboratory. S.B.S.

N79-11657*# State Univ. of New York at Stony Brook. Div. of Biological Sciences.
THE MORPHOGENETIC RESPONSES OF CULTURED TOTIPOTENT CELLS OF CARROT (DAUCUS CAROTA L.) AT ZERO GRAVITY Final Report
F. C. Steward and Abraham D. Krikorian *In* NASA. Ames Res. Center US Expt. Flown on the Soviet Satellite COSMOS 782 Sep. 1978 p 71-159 refs (For primary document see N79-11651 02-51)
(Contract NAS2-8986)
Avail: NTIS HC A18/MF A01 CSCL 06C

The development of totipotent carrot cells into organs, embryoids, and normal plantlets was studied to determine the effects of weightlessness on plant cell growth. Cells in plastic petri dishes were carried on the COSMOS 728 satellite for 19.5 days to expose them to weightlessness. A centrifuge on board the spacecraft exposed other cells to a gravity equivalent to Earth's. Results show that totipotent somatic cells can undergo morphogenesis to produce viable and fully competent embryos at zero gravity, apparently as effectively as 1 g for the test conditions used. S.B.S.

N79-11658*# San Francisco Univ., Calif. Dept. of Physics.
HZE-PARTICLE DOSIMETRY Final Report c93
D. D. Peterson, E. V. Benton, and M. Tran *In* NASA. Ames Res. Center US Expt. Flown on the Soviet Satellite COSMOS 782 Sep. 1978 p 160-178 refs (For primary document see N79-11651 02-51)
(Contract NAS2-7069)
Avail: NTIS HC A18/MF A01 CSCL 03B

An experiment designed to measure high-LET particle radiation on board the COSMOS 782 satellite is described. Plastic nuclear track detectors were used to measure flux, integral LET spectrum, charge distribution, and stopping density of high-LET particles. S.B.S.

N79-11659*# Louisville Univ., Ky. Dept. of Anatomy.
KILLFISH DEVELOPMENT IN ZERO-G ON COSMOS 782: FUNDULUS EXPERIMENT K-104 Final Report c54
J. R. Keefe, H. W. Scheld (Houston Univ., Tex.), J. F. Boyd (Northrop Serv., Inc., Houston, Tex.), P. M. Fuller, and J. M. Oppenheimer (Bryn Mawr Coll., Penn.) *In* NASA. Ames Res. Center US Expt. Flown on the Soviet Satellite COSMOS 782 Sep. 1978 p 179-199 refs (For primary document see N79-11651 02-51)
Avail: NTIS HC A18/MF A01 CSCL 06C

Fertilized eggs from Fundulus, a small shallow water minnow, were carried on board the COSMOS 782 satellite to study the possible effects of weightlessness on developing organisms. Experiment background, procedures, hardware, execution, data collection and results are presented. Results show that the development of Fundulus beyond the gastrula stage is not affected in any major way by weightlessness. It is speculated that weightlessness may be largely beneficial. S.B.S.

N79-11660*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ABSENCE OF GASTRIC ULCERATION IN RATS AFTER FLIGHT ON THE COSMOS 782 Final Report

P. A. Brown and J. Vernikos-Danellis *In its* US Expt. Flown on the Soviet Satellite COSMOS 782 Sep. 1978 p 200-206 refs (For primary document see N79-11651 02-51)

Avail: NTIS HC A18/MF A01 CSCL 06C

Evidence of gastric ulceration or severe erosion of the gastric mucosa was sought in rats following 19.5 days of spaceflight on the Cosmos 782 Biological Satellite. The stomachs from the flight animals were compared macroscopically and histologically with stomachs removed from animals in the synchronous and vivarium control groups. None of the animals in the flight or the control groups ulcerated, and there were no obvious histologic differences in gastric erosion among the groups. The reasons for this failure to ulcerate are discussed. Author

N79-11661*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EFFECT OF SPACE FLIGHT ON CELL-MEDIATED IMMUNITY Final Report

Adrian D. Mandel and Edward Balish (Wisconsin Univ., Madison) *In its* US Expt. Flown on the Soviet Satellite COSMOS 782 Sep. 1978 p 207-226 refs (For primary document see N79-11651 02-51)

Avail: NTIS HC A18/MF A01 CSCL 06C

The cell mediated immune response to Listeria monocytogens was studied in rats subjected to 19.5 days of flight in a Soviet spacecraft. Groups of rats were immunized with 1,000,000 formalin killed Listeria suspended in Freunds Complete adjuvant five days prior to flight. Immunized rats subjected to the same environmental parameters as the flight rats, excepting flight, and immunized and non-immunized rats held in a normal animal colony served as controls. Following recovery, lymphocyte cultures were prepared from spleens of all rats, and cultured in vitro in the presence of Listeria antigens, phytohemagglutinin, Conconavlin A and purified protein derivative (PPD), and measured for their uptake of H3 (thymidine). The lymphocytes of all rats gave a blastogenic response to phytohemagglutinin and Conconavlin A. Although individual rats varied considerably, all flight and immunized control rats gave a blastogenic response to the Listeria antigens and PPD. With several mitogens the lymphocytes of flight rats showed a significantly increased response over the controls. The data do not support a hypothesis of a determined effect of space flight on cell mediated immunity and suggest an opposite effect. Author

N79-11662*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EXPERIMENT K-002: RESULTS OF HISTOLOGICAL EXAMINATION OF INGUINAL LYMPH NODES, SUPPLEMENTARY REPORT Final Report

Lisbeth M. Kraft *In its* US Expt. Flown on the Soviet Satellite COSMOS 782 Sep. 1978 p 227-231 (For primary document see N79-11651 02-51)

Avail: NTIS HC A18/MF A01 CSCL 06C

Lymph nodes of the vivarium control group showed only normal variations of structure. Both nodular and diffuse arrangement of the parenchyma are found, which is further reflected in the fibrous framework as seen in picrofuchsin preparations. Active germinal centers with pyronin positive cells are found in some of the nodes of three rats of this group. Mitoses are occasionally observed. Necrotic cells and debris within the centers are normal in amount. The sinuses contain the cells usually seen: lymphocytes, histiocytes, plasma cells, and some erythrocytes. Author

N79-11663*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ALTERATIONS IN ERYTHROCYTE SURVIVAL PARAMETERS IN RATS AFTER 19.5 DAYS ABOARD COSMOS 782 Final Report

Henry A. Leon, Stephen A. Landaw (Veteran's Admin. Hosp., Syracuse, N. Y.), and Jennifer Cummins *In its* US Expt. Flown on the Soviet Satellite COSMOS 782 Sep. 1978 p 232-252 refs (For primary document see N79-11651 02-51)

Avail: NTIS HC A18/MF A01 CSCL 06C

Rats were subjected to 19.5 of weightless space flight aboard the Soviet Biosatellite, Cosmos 782. The survival parameters of a cohort of erythrocytes labeled 15.5 days pre-flight based on the output of Co-14, were evaluated upon return from orbit. These were compared to vivarium control rats injected at the same time. Statistical evaluation indicates that all survival parameters were altered by the space flight. The mean potential life span which was 62.4 days in the control rats was decreased to 59.0 days in the flight rats, and random hemolysis was increased three-fold in the flight rats. The measured size of the cohort was decreased lending further support to the idea that hemolysis was accelerated during some portion of the flight. A number of factors were discussed which might be contributory to these changes. These factors include; forces associated with launch and re-entry, atmospheric and environmental parameters, dietary factors, radiation, and weightlessness. Author

N79-11664*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EFFECTS OF SPACE FLIGHT ON PLASMA AND GLANDULAR CONCENTRATIONS OF PITUITARY HORMONES Final Report

R. E. Grindeland, L. C. Keil, S. Ellis, A. F. Parlow (Calif. Univ., Los Angeles), J. W. Kendall, Jr. (Veteran's Admin. Hosp., Portland, Oreg.), Donna Gaudette (Veteran's Admin. Hosp., Portland, Oreg.), and I. I. Geschwind (Calif. Univ., Davis) *In its* US Expt. Flown on the Soviet Satellite COSMOS 782 Sep. 1978 p 253-275 refs (For primary document see N79-11651 02-51)

Avail: NTIS HC A18/MF A01 CSCL 06C

Pituitary function was investigated in rats subjected to 19.5 days orbited space flight. Male SPF Wistar rats were divided into vivarium control (VC), synchronous control (SC), and flight (F) groups. SC rats were subjected to the same caging, RHO2, RHO2, and temperature as F rats. Rats from each treatment group were sacrificed either immediately after recovering from flight (R+0) or 25 days after recovery. Space flight caused a marginal inhibition of growth. Pituitary concentrations of hormones were similar for all groups as were the hematocrits. At R+25 F rats had decreased plasma prolactin concentrations, decreased pituitary GH and increased pituitary vasopressin; pituitary and plasma concentations of other hormones remained unchanged from control values. Hematocrits of flight rats were higher than VC and SC values at R+25 and higher than for F rats at R+0. Anterior pituitary and testicular weights were unaffected by space flight, whereas adrenal weights (2 rats from each group) were 30% heavier than controls at R+0 and 15% heavier at R+25. Flight rats also had enlarged posterior lobes. Author

N79-11665*# California Univ. at San Francisco. Dept. of Anatomy.

HISTOLOGICAL STUDIES ON TIBIAL BONE OF RATS IN THE 1975 COSMOS-782 FLIGHT. PART 1: ENDOCHONDRAL OSTEOGENESIS; MEDULLARY BONE TURNOVER Final Report

C. Willet Asling *In* NASA. Ames Res. Center US Expt. Flown on the Soviet Satellite COSMOS 782 Sep. 1978 p 276-290 refs (For primary document see N79-11651 02-51)

Avail: NTIS HC A18/MF A01 CSCL 06C

Tibia lengths, histological appearance of the proximaltibial epiphysis and metaphysis, and measurements of the bony spongiosa are reported for six rats subjected to weightlessness in earth-orbit for 19 days, and are compared with similar studies conducted on vivarium controls and on synchronous controls. Bone formation was slightly impaired in synchronous controls, and to an appreciably greater extent in flight animals. Bone resorption was moderately accelerated in synchronous controls, markedly more so in flight animals, to an extent under which virtually all pre-flight medullary bone was removed. S.E.S.

N79-11666*# California Univ. at San Francisco. Dept. of Anatomy.

HISTOLOGICAL STUDIES ON TIBIAL BONE OF RATS IN THE 1975 COSMOS-782 FLIGHT. PART 2: MICRORADIOGRAPHIC STUDY OF CORTICAL BONE Final Report

C. Willet Asling *In* NASA. Ames Res. Center US Expt. Flown on the Soviet Satellite COSMOS 782 Sep. 1978 p 291 307 refs (For primary document see N79-11651 02-51)

Avail: NTIS HC A18/MF A01 CSCL 06C

The hypothesis based on a shift in the normal balance of internal structural remodelling of bone might account for reduction of bone mineral during prolonged weightlessness in earth-orbit is discussed. Rat cortical bone made by microradiography, on samples of tibia from rats in the 1975 COSMOS-782 experiment (together with synchronous and vivarium controls) is studied. Microradiographs were examined to provide semi-quantitative measurements of bone porosity and of mineral densities ranging from minimal to maximal in four proportionate ranges. Results suggested that ranges of mineral densities in these 3 month-old vivarium control rats were in accord with findings of other on human juveniles. S.E.S.

N79-11667*# California Univ. at San Francisco.
MINERALIZATION IN TEETH AND JAWS, AS JUDGED RADIOGRAPHICALLY, IN RATS OF THE COSMOS-782 EXPERIMENT Final Report
Irene Savostin-Asling, Willet Asling, and Stanley Ellis *In* NASA. Ames Res. Center US Expt. Flown on the Soviet Satellite COSMOS 782 Sep. 1978 p 308-320 refs (For primary document see N79-11651 02-51)
Avail: NTIS HC A18/MF A01 CSCL 06C

The data on mineralization of the teeth in rats of the COSMOS-782 joint biology satellite experiment is presented. Estimations were made from radiographs by optical densitometry. The bone resorption of spongy bone in the rats in discussed. Special efforts were made to standardize the regions of tooth structure being measured, in the hoe that masses of tissue of low experimental reactivity might not obscure more highly reactive sites. S.E.S.

N79-11668*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
QUANTITATIVE ANALYSIS OF SELECTED BONE PARAMETERS Final Report
Emily Morey Holton and David J. Baylink (Veterans Admin. Hospital, Seattle) *In its* US Expt. Flown on the Soviet Satellite COSMOS 782 Sep. 1978 p 321-351 refs (For primary document see N79-11651 02-51)
Avail: NTIS HC A18/MF A01 CSCL 06C

The effect of space flight on bone formation and mineralization, bone resorption, bone length, bone density and pore size distribution, and bone mechanical properties in rats was investigated and compared to vivarium and synchronous controls. The most striking effects were found on bone formation. All parameters were investigated in the flight animals immediately after flight were significantly decreased from both the vivarium and synchronous control groups. An arrest line was found at both the endosteum and the periosteum of the flight animals suggesting that a complete cessation of bone growth occurred during space flight. By 25 days postflight, the flight animals showed a significant increase in bone formation when compared to the vivarium controls suggesting that a rebound in bone formation occurred following flight. Author

N79-11669*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
COSMIC RAY EFFECTS ON THE EYES OF RATS FLOWN ON COSMOS 782 Final Report
Delbert E. Philpott, Robert Corbett, Charles Turnbill, Gladys Harrison, David Leaffer, Sam Black, Walter Sapp, Gloria Klein, and Loya F. Savik *In its* US Expt. Flown on the Soviet Satellite COSMOS 782 Sep. 1978 p 352-381 refs (For primary document see N79-11651 02-51)
Avail: NTIS HC A18/MF A01 CSCL 06R

The eyes from six rats were fixed at the recovery site in Russia after circling the earth for 19.5 days in a 62.8 deg orbit. Twelve more flight eyes were fixed 25 days later. These two preparations and eyes exposed to 1000 rads of neon and argon, were compared to obtain data on possible radiation effects on the retina. The outer nuclear layer was examined for radiation changes because these nuclei control the synthesis of the outer segments. Necrotic nuclei were found in the outer nuclear layer and channels were located in the outer segment area. Macrophages were seen between the pigment layer and outer segments. Comparison of the zero day and 25 day postflight eyes suggested some possible recovery. Flight flashes seen by space travelers and damage from cosmic rays appeared to arise from two different sites of interaction. The flashes are created by cosmic ray traversal of the outer segments while pathology, when it occurs, is quite possibly from interaction with some part of the nucleus. Author

N79-11670*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF WEIGHTLESSNESS ON THE EMBRYONIC DEVELOPMENT AND AGING OF DROSOPHILA Final Report
J. Miquel, D. E. Philpott, P. R. Lundgren, R. Binnard, and C. E. Turnbill *In its* US Expt. Flown on the Soviet Satallite COSMOS 782 Sep. 1978 p 382-409 refs (For primary document see N79-11651 02-51)
Avail: NTIS HC A18/MF A01 CSCL 06C

The biological effects of weightlessness were investigated on Drosophila melanogaster of the Domodedov-32 strain, which developed and spent the first days of adult life in space. Following a 19.5 day exposure to zero g, the flies were studied by morphological, chemical and behavioral techniques. The development of Drosophila was insensitive to weightlessness and the aging process was not influenced, except for a slight reduction in the amount of lipofuscin present in the midgut and Malpighian tubules. Author

N79-11671*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
US EXPERIMENTS FLOWN ON THE SOVIET SATELLITE COSMOS 936 Final Reports
Susan N. Rosenzweig (Northrop Services, Inc., Anaheim, Calif.) and Kenneth A. Souza Sep. 1978 295 p refs
(NASA-TM-78526; A-7616) Avail: NTIS HC A13/MF A01 CSCL 06B

Results of spaceborne experiments onboard the Cosmos 936 satellite are reported. Alterations in normal bone chemistry, muscle structure, and general physiology resulting from spaceflight are covered along with measurements of cosmic radiation and its potential hazard to man during prolonged spaceflights. Postflight activities involving the seven U.S. experiments are emphasized. For individual titles, see N79-11672 through N79-11679.

N79-11672*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE COSMOS 936 MISSION Final Report
Kenneth A. Souza *In its* US Expt. Flown on the Soviet Satellite COSMOS 936 Sep. 1978 p 1-31 refs (For primary document see N79-11671 02-51)
Avail: NTIS HC A13/MF A01 CSCL 06C

Cosmos 936, an unmanned spacecraft carrying biology and physics experiments from 9 countries, including both the Soviet Union and the U.S., is described. An overview of the mission focusing on preflight, on-orbit, and postflight activities pertinent to the seven U.S. experiments aboard Cosmos 936 is presented. J.M.S.

N79-11673*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
EFFECTS OF WEIGHTLESSNESS ON THE GENETICS AND AGING PROCESS OF DROSOPHILA MELANOGASTER Final Report
Jaime Miquel and Delbert E. Philpott *In its* US Expt. Flown on the Soviet Satellite COSMOS 936 Sep. 1978 p 32-59 refs (For primary document see N79-11671 02-51)
Avail: NTIS HC A13/MF A01 CSCL 06C

The biological effects of space flight were investigated on fruit flies (male Drosophila melanogaster Oregon R), in an experiment planned jointly with the USSR. The effects of near-weightlessness on the developmental and aging processes were studied. Larval cultures and mature flies (imagoes) were exposed to the space environment onboard the Cosmos 936 biosatellite. It is shown that the effect of hypogravity on the development processes of Drosophila is negligible. In effect, detailed investigation by scanning and transmission electron microscopy of flies which had developed in space shows that the external morphology and the internal fine structure of these insects are perfectly normal. This suggests that, at least in Drosophila, the mechanism of cell division and differentiation associated with growth and morphogenesis are not appreciably influenced by the lack of gravity. The fly populations which were

exposed to near-weightlessness during the young or middle age phases of their adult life span show reduced vitality and a detrimental effect on longevity. J.M.S.

N79-11674*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

EFFECT OF WEIGHTLESSNESS AND CENTRIFUGATION (LXG) ON ERYTHROCYTE SURVIVAL IN RATS SUBJECTED TO PROLONGED SPACE FLIGHT Final Report

Henry A. Leon, Stephen A. Landaw (Veterans Administration Hospital, Syracuse, N. Y.), and Luba V. Serova (Inst. for Biomedical Problems, Moscow) *In its* US Expt. Flown on the Soviet Satellite COSMOS 936 Sep. 1978 p 60-76 refs (For primary document see N79-11671 02-51)

Avail: NTIS HC A13/MF A01 CSCL 06S

Rats were flown aboard the biosatellite Cosmos 936 for 18.5 days. Five rats were subjected to near-weightless space flight and five rats were subjected to a one g force via an onboard centrifuge. These rats, and 3 control groups were injected with 2-C-14 glycine 19 days preflight. The flight rats were recovered from orbit after 18.5 days of space flight. Erythrocyte hemolysis and life span were evaluated in the five groups of rats by quantitation of radioactive carbon monoxide exhaled in the breath, which arises from the breakdown of the previously labeled hemoglobin. The results are supportive of previous findings, wherein hemolysis was found to increase as a result of weightless space flight. A comparison with the centrifuged animals indicates that artificial gravity attenuates the effect of weightlessness on hemolysis and appears to normalize the hemolytic rate in the early postflight period. J.M.S.

N79-11675*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

COSMOS 936, EXPERIMENT K204: THE EFFECTS OF SPACE FLIGHT ON SOME LIVER ENZYMES CONCERNED WITH CARBOHYDRATE AND LIPID METABOLISM IN THE RAT Final Report

S. Abraham (Children's Hospital Medical Center of Northern Calif.), H. P. Klein, C. Y. Lin (Children's Hospital Medical Center of Northern Calif.), and C. Volkmann *In its* US Expt. Flown on the Soviet Satellite COSMOS 936 Sep. 1978 p 78-134 refs (For primary document see N79-11671 02-51)

Avail: NTIS HC A13/MF A01 CSCL 06C

The activities of about 30 enzymes concerned with carbohydrate and lipid metabolism and the levels of glycogen and of the individual fatty acids in hepatic lipids in rat livers exposed to space flight conditions were examined. Statistically significant decreases in the activity levels of glycogen phosphorylase, alpha-clycerol phosphate acyl transferace, diglyceride acyl transferace, aconitase, and 6-phosphoglocomate dehydragenase were noted in the weightless group. All enzyme activities returned to normal 25 days postflight. When the liver glycogen and the total fatty acids of the flight animals were determined, significant differences that could be attributed to reduced group at recovery contained more than twice the amount of glycogen than did the centrifuged controls and a remarkable shift in the ratio of palmitate to palmitoleate was noted. J.M.S.

N79-11676*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

QUANTITATIVE ANALYSIS OF SELECTED BONE PARAMETERS Final Report

Emily Morey Holton, Russell T. Turner (Veterans Administration Hospital, Tacoma, Wash.), and David J. Baylink (Veterans Administration Hospital, Tacoma, Wash.) *In its* US Expt. Flown on the Soviet Satellite COSMOS 936 Sep. 1978 p 135-183 refs (For primary document see N79-11671 02-51)

Avail: NTIS HC A13/MF A01 CSCL 06S

The effect of space flight on bone formation, bone resorption, bone length, bone density and pore size distribution, bone mechanical properties, and bone cell number in both flight and 1 G flight centrifuged rats was investigated and compared to ground control groups. The data obtained suggest that no gross change in endosteal bone resorption occurs during flight or postflight; that mean periosteal bone formation rate decreases about 45% and is not corrected by centrifugation; that the decrease in formation rate may be due, in part, to a cessation of bone formation which occurs sometime after the eleventh day of flight and continues until the second postflight day; that although centrifugation did not correct the defect in periosteal bone formation rate during flight, it appears to hasten the recovery following flight; that femor stiffness decreases about 30%; and that centrifugation did correct the defect in bone mechanical properties. All perturbations produced by space flight returned to or exceeded normal values by 25 days after flight. Author

N79-11677*# San Francisco Univ., Calif. Physics Research Group.

SPACE RADIATION DOSIMETRY ONBOARD COSMOS 936: US PORTION OF EXPERIMENT K-206 Final Report

E. V. Benton, R. Cassou, A. Frank, R. P. Henke, and D. D. Peterson *In* NASA Ames Res. Center US Expt. Flown on the Soviet Satellite COSMOS 936 Sep. 1978 p 184-245 refs (For primary document see N79-11671 02-51)

(Contract NAS2-9504)

Avail: NTIS HC A13/MF A01 CSCL 06R

The space radiation environment was investigated in a joint U.S. - U.S.S.R. experiment onboard the Cosmos 936 biosatellite. Results derived from measurements made in a variety of passive radiation detectors including plastic nuclear track detectors, fission foil detectors, thermoluminescence dosimeters, and nuclear emulsions are reported. The mean observed HZE particle flux, as measured in cellulose nitrate plastic detectors, was 1.75 sq cm/day (+ 20%). The fluences of thermal neutrons, resonance neutrons, and high energy neutrons were, respectively, 364, 000 sq cm, 950,000 sq cm, and 2,100,000 sq cm the total dose, as measured in TLD chips located at two sites in the U.S. - 25% part of the K-206 container, was 424 mrad (+ 9%) and 523 mrad (+ 11%). The mean tissue equivalent proton ender density, as measured in nuclear emulsions located in the U.S. - 25% part, was 272,000 cu cm/tissue. The physical parameters of the radiation environment reported help specify important dosimetric information required to assess the potential radiation hazards to life systems in space. J.M.S.

N79-11678*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

COSMIC RAY EFFECTS ON THE EYES OF STATIONARY AND CENTRIFUGED RATS FLOWN ON COSMOS 936, EXPERIMENT K-207 Final Report

Delbert E. Philpott, Robert Corbett, Charles Turnbill, Sam Black, Dayhoff, Jackie McGourty, Robert Lee, and Gladys Harrison *In its* US Expt. Flown on the Soviet Satellite COSMOS 936 Sep. 1978 p 246-273 refs (For primary document see N79-11671 02-51)

Avail: NTIS HC A13/MF A01 CSCL 06R

Ten rats, 5 centrifuged during flight to simulate gravity and 5 in flight stationary experiencing hypogravity, orbited the earth in a 62.8 deg orbit for 18.5 days in the Russian satellite Cosmos 936. The animals were sacrificed 25 days post-recovery and the eyes were enucleated and fixed immediately. No differences were noted comparing flight stationary to flight centrifuged. Affected cells in the outer nuclear layer, where synthesis of the outer segment takes place, showed swelling, clearing of cytoplasm, and disruption of the membranes. Channels were again found similar to those seen in K-007. Preliminary results using the digitizer to quantitate the tissue response indicated an increase in cell size after radiation and decrease in the number of cells in the outer nuclear layer. Author

N79-11679*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

COSMOS 936, EXPERIMENT K-208: SPACEFLIGHT EFFECTS ON MUSCLE FIBERS Final Report

Kenneth R. Castleman, Luis A. Chui (Univ. of Southern Calif., Los Angeles), and Joseph P. Vandermeulen (Univ. of Southern Calif., Los Angeles) *In* NASA. Ames Res. Center US Expt. Flown on the Soviet Satellite COSMOS 936 Sep. 1978 p 274-289 refs (For primary document see N79-11671 02-51)

Avail: NTIS HC A13/MF A01 CSCL 06S

Muscle fiber size and type distribution were studied in the extensor digitorium longus (e.d.1.) muscle of 15 COSMOS 936 rats. The groups studied include 5 flight stationary, 5 synchronous stationary, and 5 vivarium control animals. Of the 3 groups, average fiber diameter was largest in the vivarium control animals and smallest in the flight animals. Flight muscles appeared to be shorter than those of the other groups. Fiber number showed

no significant difference. The e.d.1. contains predominantly fast twitch fibers. The slow fiber percentage was quite variable in these animals, and no statistically significant fiber type conversion was noted. J.M.S.

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Includes physiological factors, biological effects of radiation; and weightlessness.

N79-11680 Carnegie-Mellon Univ., Pittsburgh, Pa.
CALCIUM REGULATION IN SMOOTH MUSCLE: ISOLATION AND CHARACTERIZATION OF THE MYOSIN LIGHT CHAIN KINASE Ph.D. Thesis
Debra Kay Aromatorio 1978 161 p
Avail: Univ. Microfilms Order No. 7815193

The most widely accepted theory for Ca(2+) regulation in smooth muscle involves the Ca(2+) dependent phosphorylation of the myosin 20,000 dalton light chain. Although most of the evidence favors a dominant role for phosphorylation in the control mechanism, a direct correlation between actin-activation and phosphorylation has not been previously established, since heterogeneous preparations of the kinase were used. In an attempt to demonstrate a direct correlation between these two events the Ca(2+) dependent protein kinase (ATP: myosin light chain phosphotransferase) from chicken gizzard was isolated and characterized. Dissert. Abstr.

N79-11681 Southern Illinois Univ. at Carbondale.
CARDIOVASCULAR, METABOLIC, AND RESPIRATORY RESPONSES OF SEDENTARY FEMALES TO EQUAL METABOLIC WORKLOADS ON THE BICYCLE ERGOMETER AND TREADMILL Ph.D. Thesis
Daniel Stephen Miles 1978 139 p
Avail: Univ. Microfilms Order No. 7817537

The relationships between heart rate, stroke volume, cardiac output, difference in oxygen content between arterial and mixed venous blood difference, and oxygen uptake during cycling and running at 30%, 60%, and 80% of aerobic work capacity in females was studied. Ventilatory responses were analyzed to determine the influence of acid-base imbalance at equivalent metabolic workloads. Eighteen female subjects were divided into three age groups of 6 individuals each, to analyze the influence of age on cardiovascular, metabolic, and respiratory responses to exercise. Cardiovascular adjustments to equivalent metabolic workloads on the bicycle ergometer and treadmill were very similar. However, there was a greater degree of metabolic acidosis present for equivalent work on the bicycle ergometer compared to the treadmill. There was no consistent difference between age groups when comparisons were made for cardiovascular, metabolic, and respiratory responses to work on either the bicycle ergometer or treadmill. Dissert. Abstr.

N79-11682 Johns Hopkins Univ., Baltimore, Md.
THE EFFECTS OF CARBON MONOXIDE AND CYANIDE ON THE BRAIN Ph.D. Thesis
Bruce Robert Pitt 1978 227 p
Avail: Univ. Microfilms Order No. 7817971

The potential toxicological effects of carbon monoxide and cyanide were examined to provide a physiologic basis for their effects on victims of fires. Experiments were performed on anesthetized paralyzed dogs. Cerebral venous blood flow (CBF) was measured at the confluence of the sagittal, straight and lateral sinuses, with the lateral sinuses occluded. The similarities of the brain's response to CN or CO, the additive effect of CN and CO on CBF and the consistency of the CBF to VO2 relationship for combinations of CO and CN suggest that these two agents are physiologically additive. The toxicity of the fire environment may be underestimated by considering only the inventory of combustion products without taking into account possible interactions. THe additive effect of CN and CO on CBF, and the more than additive effect on VO2, may explain the altered central nervous system function and failure to escape by individuals confronted with the fire environment. Dissert. Abstr.

N79-11683*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
VESTIBULAR FUNCTION RESEARCH (VFR) EXPERIMENT. PHASE B: DESIGN DEFINITION STUDY Final Report
24 May 1978 307 p
(Contract NAS2-9781)
(NASA-CR-152207; LMSC-D-626121) Avail: NTIS HC A14/MF A01 CSCL 06S

The Vestibular Functions Research (VFR) Experiment was established to investigate the neurosensory and related physiological processes believed to be associated with the space flight nausea syndrome and to develop logical means for its prediction, prevention and treatment. The VFR Project consists of ground and spaceflight experimentation using frogs as specimens. The phase B Preliminary Design Study provided for the preliminary design of the experiment hardware, preparation of performance and hardware specification and a Phase C/D development plan, establishment of STS (Space Transportation System) interfaces and mission operations, and the study of a variety of hardware, experiment and mission options. The study consist of three major tasks: (1) mission mode trade-off; (2) conceptual design; and (3) preliminary design. G.Y.

N79-11684*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SUBCUTANEOUS CHANNELING PROBE Patent Application
Gordon F. Lund (NAC-NRC), Richard C. Simmonds, and Bill A. Williams, inventors (to NASA) Filed 31 Oct. 1978 12 p
(NASA-Case-ARC-11091-1; US-Patent-Appl-SN-956162) Avail: NTIS HC A02/MF A01 CSCL 06B

The subcutaneous channeling probe 15 provided an instrument for use in the placement of biosensors with long leads in animals. The probe channeled subcutaneously through connective tissue from the site of lead entry 4 to the site of biosensor placement. After securing a sensor to the end of the probe, the probe was pulled out of an exit incision 5, guiding the biosensor and lead into place. The probe was constructed of flexible rod material, such as standard 9.5 mm (3/8 inch) nylon rod and was provided with blunted pointed tips; spearhead tip 8 and tapered end tip 9. This design permitted the efficient channeling of the instrument through connective tissue when force was exerted through the rod. However, because of the blunted edges 19 and tips, the actual cutting of the connective tissue was kept to a minimum. Further, the probe was constructed in sections 16, 17, and 18. NASA

N79-11685# Franklin Inst. Research Labs., Rockville, Md. Science Information Services Dept.
A LITERATURE REVIEW-PROBLEM DEFINITION STUDIES ON SELECTED TOXIC CHEMICALS. VOLUME 2: OCCUPATIONAL HEALTH AND SAFETY ASPECTS OF PHOSPHORUS SMOKE COMPOUNDS Final Report, Mar. 1977 - Apr. 1978
Khizar Wasti, K. J. R. Abaidoo, and Jon E. Villaume Apr. 1978 104 p refs
(Contract DAMD17-77-C-7020)
(AD-A056019) Avail: NTIS HC A06/MF A01 CSCL 06/20

This Problem Definition Study provides information on toxicological aspects and health hazards of phosphorus smoke compounds. The compounds covered in this study are red phosphorus, white phosphorus, butyl rubber/red phosphorus, plasticized white phosphorus, and epoxy white phosphorus. The subjects covered in this review are chemical and physical properties, toxicity, pharmacokinetics, sampling and analysis, industrial hygiene and safety practices, and standards. Recommendations for further toxicological studies on animals are also provided. There is virtually no information on the toxicity of butyl rubber/red phosphorus, plasticized white phosphorus, or epoxy white phosphorus. The toxicity of red phosphorus has not been studied very well. White phosphorus has been found to be highly toxic to both experimental animals and humans. Occupational exposure to white phosphorus vapors has produced necrosis of the jaw ('phossy jaw') among workers. There have been no reported cases of carcinogenicity in humans after white phosphorus intoxication. Tests for mutagenicity and teratogenicity have not been reported in the literature. Author (GRA)

N79-11686# Franklin Inst. Research Labs., Rockville, Md. Dept. of Science Information Services.

A LITERATURE REVIEW-PROBLEM DEFINITION STUDIES ON SELECTED TOXIC CHEMICALS. VOLUME 1: OCCUPATIONAL HEALTH AND SAFETY ASPECTS OF DIESEL FUEL AND WHITE SMOKE GENERATED FROM IT Final Report, Mar. 1977 - Apr. 1978

Deborah Liss-Suter and Richard Mason Apr. 1978 66 p refs (Contract DAMD17-77-C-7020; DA Proj. 3E7-62720-A-835) (AD-A056018) Avail: NTIS HC A04/MF A01 CSCL 06/20

Literature is reviewed (75 references) covering analysis, physical and chemical properties, human and animal toxicology, mammalian pharmacokinetics, industrial standards and occupational hazards of diesel fuel and white smoke (an aerosol mixture of diesel fuel, additives, diesel engine exhaust and pyrolysis products). Diesel fuel is an aliphatic and aromatic hydrocarbon mixture obtained from the straight-run distillation of petroleum and often blended with cracked fuels. Composition is controlled only by physical properties (boiling range, flash point, viscosity, cetane number); additives improve combustibility, reduce corrosiveness and reduce gum formation. The smoke is generated by feeding diesel fuel into the exhaust manifold of a diesel engine, creating a vapor which condenses into an opaque mass of microdroplets which may be useful in screening military equipment and personnel. The health hazards of exposure to white smoke have not been studied, although pure diesel fuel aerosols do not appear to be irritating to the respiratory tract or skin of humans during acute exposures to relatively low concentrations. Dermatitis following direct contact with diesel fuel is reportedly due to a combination of poor occupational hygiene and constitutional factors. Ingestion of diesel fuel results in gastritis and patchy destruction of the gastric mucosa. GRA

N79-11687# Franklin Inst. Research Labs., Rockville, Md. Dept. of Science Information Services.

A LITERATURE REVIEW-PROBLEM DEFINITION STUDIES ON SELECTED TOXIC CHEMICALS. VOLUME 5: OCCUPATIONAL HEALTH AND SAFETY AND ENVIRONMENTAL ASPECTS OF ZINC CHLORIDE Final Report, Mar. 1977 - Apr. 1978

Harriet Glaser Hill and Khizar Wasti Apr. 1978 123 p refs (Contract DAMD17-77-C-7020; DA Proj. 3E7-62720-A-835) (AD-A056020) Avail: NTIS HC A06/MF A01 CSCL 06/20

This Problem Definition Study provides a literature review (113 references) on occupational health hazards and environmental aspects of zinc chloride which is a major product of a smoke generated from HC (hexachloroethane) mixture for screening purposes and fire-fighting exercises. Included are physical and chemical properties, human and animal toxicity, effects on microorganisms, plants, and aquatic organisms, pharmacokinetics, fate in the environment, industrial safety standards and practices, and sampling and analysis methodology of zinc chloride. Environmental impact are discussed and recommendations for further studies are provided. Zinc chloride is hygroscopic and astringent and has been found to be toxic if inhaled at elevated concentrations or in enclosed spaces with inadequate ventilation. In occupational exposure, contact with the skin, eyes, or nose can cause severe burns. Ingestion of zinc chloride solutions can result in severe gastrointestinal ulceration. No evidence exists in the literature that zinc chloride is mutagenic. Injection of zinc chloride solutions into the yolk sacs of chicken eggs induced teratogenic effects. Teratogenic effects in other species have not been reported in the literature. There have been no reported cases of carcinogenicity due to zinc chloride exposure in humans. GRA

N79-11688# Franklin Inst. Research Labs., Rockville, Md. Dept. of Science Information Services.

A LITERATURE REVIEW-PROBLEM DEFINITION STUDIES ON SELECTED TOXIC CHEMICALS. VOLUME 8: ENVIRONMENTAL ASPECTS OF DIESEL FUEL AND FOG OILS SGF NUMBER 1 AND SGF NUMBER 2 AND SMOKE SCREENS GENERATED FROM THEM Final Report

Deborah Liss-Suter Apr. 1978 132 p refs (Contract DAMD17-77-C-7020; DA Proj. 3E7-62720-A-835) (AD-A056021) Avail: NTIS HC A07/MF A01 CSCL 06/20

In this literature review (117 references) on the environmental aspects of fog oils and diesel fuel and the smoke screens, or fogs, generated from them, the topics which are investigated include the effects of petroleum fuels and lubricants on waterfowl and birds, insects, plants, soil nematodes, fish, marine worms, molluscs, crustaceans, and other marine species, phytoplankton, microorganisms and zooplankton. In addition to acute toxicity of these petroleum oils in most species, adverse effects on reproduction, carcinogenicity, chemically-mediated behavior disruption, and inhibition of photosynthesis, among others, are reported for various organisms. Factors influencing the atmospheric dispersion of the oil smokes, and the dispersion and persistence of the oil films on soil, water, and vegetation resulting from the settling of the oil smoke to ground level are reviewed, as well as pathways by which these petroleum oils are chemically and biologically degraded, and their uptake and accumulation in species ranging from algae through fish and shellfish to humans. Current techniques for sampling and analysis of fog oils and diesel fuel in water, soil and biological media are presented. GRA

N79-11689# Dynamic Science, Phoenix, Ariz.

ANALYSIS OF NAVAL AVIATION HEAD AND NECK INJURIES (1969-1978) Final Report, May 1971 - May 1978

L. H. Tyndall and R. W. Carr May 1978 101 p refs (Contract N00014-71-C-0318; RR0130301) (AD-A057657; Rept-0249-78-81) Avail: NTIS HC A06/MF A01 CSCL 06/16

U.S. Naval aviation accidents during the period January 1969 to March 1978 were reviewed to study the nature and severity of injuries to the head and neck. Results, by aircraft models and types, were tabulated and analyzed to determine the number and types of injuries to the skull, face, eyes, neck, and cervical vertebra; this information was then used to determine the primary impact force direction. The role of the helmet in injury causation or prevention was also considered in the final directional determination. Author (GRA)

N79-11690# Desmatics, Inc., State College, Pa.

AN EXAMINATION OF STATISTICAL IMPACT ACCELERATION INJURY PREDICTION MODELS BASED ON -Gx ACCELERATOR DATA FROM SUBHUMAN PRIMATES

Dennis E. Smith Aug. 1978 35 p refs (Contract N00014-74-C-0154; NR Proj. 207-037) (AD-A057276; TR-102-6) Avail: NTIS HC A03/MF A01 CSCL 06/19

This report considers the application of an impact acceleration injury prediction model to observed data from a set of twenty-eight -G sub x accelerator runs involving subhuman primates (Rhesus monkeys) with securely restrained torso and unrestrained head. The data was collected by the Naval Aerospace Medical Research Laboratory (NAMRL) Detachment as part of its research effort on acceleration impact injury prevention. Using a common data base, two different models were constructed, one based on sled profile variables and the other based on head dynamic response variables. Although the latter model provided a reasonable fit given the small size of the data set, the other model (based on sled profile variables) resulted in a much better fit. Possible explanations for this seemingly anomalous result are listed and additional accelerator runs are suggested. Author (GRA)

N79-11691# California Univ., Livermore. Lawrence Livermore Lab.

QUANTITATIVE REVIEW OF HUMAN SUSCEPTIBILITY TO MAGNETIC FIELDS

A. Schiff Mar. 1978 33 p refs (Contract W-7405-eng-48) (UCID-17773) Avail: NTIS HC A03/MF A01

The effects of magnetic fields on humans and animals was investigated. Quantification of exposure time to the fields by the subjects was considered. The importance of some parameters such as the distinction between uniform and gradient fields and orientation between subjects and the magnetic fields was also considered. Results suggest avoiding exposure to several types of magnetic fields: alternating-current fields in the body-function frequencies at any magnetic intensity (0.3 to 10 Hz and 18 to 30 Hz); all frequencies for extended periods at intensities above 20 mT(200 gauss) (T = tesla); and all frequencies greater than 10 Hz at levels above 0.1 mT(1 gauss) for people with cardiac pacemakers. DOE

N79-11692# Advisory Group for Aerospace Research and Development, Paris (France).

PROSPECTIVE MEDICINE OPPORTUNITIES IN AEROSPACE MEDICINE

J. H. Triebwasser, ed. (School of Aerospace Med.) Sep. 1978 100 p refs Presented at Aerospace Medical Panel's 34th Panel Meeting/Specialists' Meeting, London, 24-28 Oct. 1977

(AGARD-CP-231; ISBN-92-835-1293-6) Avail: NTIS HC A05/MF A01

Various applications of prospective medicine techniques are discussed with relation to the practice of aerospace medicine. Studies were conducted on special population of military aircrew in the prevalence incidence of findings. Multiple risk assessments, correlation of with disease risks, and results of efforts to modify the risk for disease and their clinical manifestations were examined. For individual titles, see N79-11693 through N79-11704.

N79-11693# National Defence Headquarters, Ottawa (Ontario). Directorate of Preventive Medicine.

THE CANADIAN FORCES LIFE QUALITY IMPROVEMENT PROGRAMME

John E. Bardsley *In* AGARD Prospective Med. Opportunities in Aerospace Med. Sep. 1978 6 p (For primary document see N79-11692 02-52)

Avail: NTIS HC A05/MF A01

The Canadiah Gorces introduced a life quality improvement program to counteract the ravages of diseases which arise from risks prevalent in most lifestyles in Western society. These so called diseases of choice are discussed in terms of their self-imposed risks. A summary of the program concept is given centering around 15 factors and six philosophies deemed essential for success. Central in the program is the individual assessment which is composed of various biomeasurements, a health hazard appraisal, a health questionnaire and an interview. In support of this assessment will be an educational/promotional campaign and a variety of supportive clinics. B.B.

N79-11694*# National Aeronautics and Space Administration, Washington, D. C.

THE ROLE OF PHYSICAL EXAMINATIONS AND EDUCATION IN PROSPECTIVE MEDICINE

Walton L. Jones, Jean Mockbee, Carolyn K. Snow, and J. Richard Compton (Natl. Health Services, Inc.) *In* AGARD Prospective Med. Opportunities in Aerospace Med. Sep. 1978 9 p refs (For primary document see N79-11692 02-52)

Avail: NTIS HC A05/MF A01

NASA's prospective medicine program, with the principal elements of physical examinations and an educational program for health awareness is described. Participation in the voluntary physical examination program is increasing. In 1976 13,621 employees were given partial or complete examination in NASA Health Units. From the 941 examinations performed at NASA Headquarters in 1976, 522 principal findings were detected. Equipment and techniques in exercise EKG, tonometry, and colonoscopy were partially responsible for this high rate. The health awareness program includes consultations with physicians, training devices and courses, health bulletins, and special screening programs. Epidemiological studies, now underway, will be used to evaluate the health awareness programs. B.B.

N79-11695# Naval Aerospace Medical Research Lab., New Orleans, La.

MEDICAL QUALIFICATION PROCEDURES FOR HAZARDOUS-DUTY AEROMEDICAL RESEARCH

D. J. Thomas, P. L. Majewski, C. L. Ewing, and N. S. Gilbert *In* AGARD Prospective Med. Opportunities in Aerospace Med. Sep. 1978 13 p refs (For primary document see N79-11692 02-52)

Avail: NTIS HC A05/MF A01

Volunteer subjects were recruited for hazardous duty impact and vibration acceleration stress experiments during the past 10 years. Dental and lumbosacral spinal abnormalities are the major cause of disqualification. From a group of 1,277 prospective volunteers, only 63 (4.9 percent) were qualified and only 44 (3.4 percent) successfully completed the experimental program. The procedures and findings of the selection program are presented. Volunteers were recruited, evaluated, and used in strict accordance with specified procedures. B.B.

N79-11696# Federal Aviation Administration, Washington, D. C.

EXPERIENCE WITH PERIODIC AVIATION MEDICAL EXAMINATIONS

Edwin E. Westura *In* AGARD Prospective Med. Opportunities in Aerospace Med. Sep. 1978 15 p refs (For primary document see N79-11692 02-52)

Avail: NTIS HC A05/MF A01

Personal observations and experience with civilian aviation medical examinations and the Federal Aviation Administration (FAA) certification system from June 1964 through June 1977 are presented. Special attention was devoted to methods used in the assessment of the cardiovascular system. Emphasis was placed upon a systematic approach to those cardiovascular conditions, especially coronary heart disease, which might adversely affect pilot performance, and which present a hazard to public safety. Coronary heart disease and its clinical manifestations are the major cardiovascular problem in United States civilian aviation medicine today. Evaluation techniques were used in detecting potentially dangerous conditions. B.B.

N79-11697# School of Aerospace Medicine, Brooks AFB, Tex. Clinical Sciences Div.

A PROSPECTIVE MEDICINE APPROACH TO THE PROBLEM OF ISCHEMIC VASCULAR DISEASE IN THE USAF

Malcolm C. Lancaster *In* AGARD Prospective Med. Opportunities in Aerospace Med. Sep. 1978 5 p refs (For primary document see N79-11692 02-52)

Avail: NTIS HC A05/MF A01

A program of ischemic vascular disease risk factor identification and intervention is described. An individual risk calculation was performed which identifies the current risk for the individual and also projects the effect of modification of individual risk upon the combined risk figure. B.B.

N79-11698# Medizinische Poliklinik der Univ., Wuerzburg (West Germany).

THE SIGNIFICANCE OF RHYTHM DISTURBANCES IN ASYMPTOMATIC PERSONS

Armin Dietz and Josef Walter *In* AGARD Prospective Med. Opportunities in Aerospace Med. Sep. 1978 6 p refs (For primary document see N79-11692 02-52)

Avail: NTIS HC A05/MF A01

Nearly all rhythm disturbances can be found in persons without clinically significant heart disease. Various ECG methods and epidemiologic studies help to clarify their prognosis. The results of such investigations are of special importance to aviation medicine, because arrhythmias can cause sudden incapacitation. Those arrhythmias occurring in a well controlled asymptomatic population such as flying personnel are described. The immediate hemodynamic consequences of these ECG alterations and possible prognostic implications for the incidence of sudden dangerous arrhythmias are discussed. B.B.

N79-11699# School of Aerospace Medicine, Brooks AFB, Tex. Internal Medicine Branch.

DISTINGUISHING BORDERLINE HYPERTENSIVES FROM NORMOTENSIVES: A CLINICAL STUDY OF 300 AIRCREWMEN

David H. Hull, Roger A. Wolthuis, Joseph R. Fischer, John H. Triebwasser, Jacki T. Curtis, and Donald A. McAfoose *In* AGARD Prospective Med. Opportunities in Aerospace Med. Sep. 1978 8 p refs (For primary document see N79-11692 02-52)

Avail: NTIS HC A05/MF A01

Ambulant aircrewmen (299) referred to a clinical consultation service were evaluated with a brief orthostatic test: blood pressure (BP) and heart rate were recorded alternately during both supine rest and 5 minutes of quiet standing. The patients were divided into four groups depending on BP history (normotension vs. borderline hypertension) and BP from the current clinical examination (normal vs. elevated). During supine rest, most patients with a normotensive history and a majority of those with a borderline hypertensive history and BPs in the normal range. During stand, BP remained normal in most normotensives but was elevated in a majority (62 percent) of borderline

hypertensives. These results were used to compute the probability of borderline hypertension in an individual patient, given either the BP from his current clinical examination or the average BP from the stand part of his orthostatic test, or both. Curves were constructed showing this probability in populations with various prevalences of borderline hypertension. The value of an orthostatic test combined with a standard clinical BP in distinguishing between borderline hypertension and normotension was apparent. B.B.

N79-11700# Naval Air Development Center, Warminster, Pa. Biochemistry Lab.

MOLECULAR DETERMINANTS FOR THE PREDICTION AND SURVIVAL OF ISCHEMIC ANOXIC STRESS PATHOLOGY

B. David Polis *In* AGARD Prospective Med. Opportunities in Aerospace Med. Sep. 1978 5 p refs (For primary document see N79-11692 02-52)

Avail: NTIS HC A05/MF A01

Quantitation of membrane phospholipids in mitochondria and microsomes from acceleration stressed as well as radiation stressed animals revealed significant variations in individual species of phospholipids which were reiterated in the blood plasma. Application of the methodology to humans showed the feasibility of achieving a molecular index to stress via blood plasma phospholipids. These results were complimented with studies for noninvasive procedures using the techniques of high pressure liquid chromatography and electron spin resonance spectroscopy to detect excited state metabolites in urine which could be correlated with stress intolerance. With this procedure a significant increase in free radical forming species was found in the urine of volunteers centrifuged to grayout as well as in a civilian population of patients scheduled for heart surgery. Correlation of the free radical concentrations with values for lipid peroxides and phenolic compounds have a three dimensional readout which separated stress tolerant individuals from those with debilitating intolerance to stress. Author

N79-11701# School of Aerospace Medicine, Brooks AFB, Tex. Neuropsychiatry Branch.

PSYCHOSOCIAL ASPECTS OF SYNCOPE AND VERTIGO IN AIRCREW

James A. Boydstun and William H. Sledge *In* AGARD Prospective Med. Opportunities in Aerospace Med. Sep. 1978 7 p refs (For primary document see N79-11692 02-52)

Avail: NTIS HC A05/MF A01

For an 8.5 month period, all cases (N=47) referred to the USAF School of Aerospace Medicine for evaluation of syncope, vertigo, or dizziness were seen for a standardized psychiatric interview, mental status examination, hyperventilation experience, and psychometrics. Twenty-one patients reported that their symptoms of hyperventilation were the same as or very similar to their reference symptoms. The findings from the subgroup were analyzed and compared to a group of 31 control subjects. The study group reported a great deal more symptoms after hyperventilating (a checklist was used). They were much more apt to report job maladjustment, parental conflict, and separation from their families. Common mental status findings were low self-esteem worry, helplessness, fearfulness, suspiciousness, evasive guardedness, meticulousness, and perfectionism. Their prominent mental defense mechanisms included projection, intellectualization, and repression. The Cornell Index and Cattell's 16 PF showed significant group differences. Author

N79-11702# Royal Air Force Hospital, Halton (England).

BETA-ADRENOCEPTOR ANTAGONISTS: CENTRAL EFFECTS

J. N. C. Cooke and A. N. Nicholson (Royal Air Force Inst. of Aviation Med.) *In* AGARD Prospective Med. Opportunities in Aerospace Med. Sep. 1978 3 p refs (For primary document see N79-11692 02-52)

Avail: NTIS HC A05/MF A01

Beta-adrenoceptor antagonists used widely in therapeutics, and intended for the treatment of angina pectoris and cardiac arrythmias were reviewed. Their ability to lower blood pressure in hypertension proved to be the major clinical application. These drugs aroused interest in aviation medicine because of their possible use in the management of mild hypertension, but the question arises whether their use in aircrew may be accompanied by unacceptable changes in the function of the central nervous system. There is evidence that their hypotensive effect may involve cerebral mechanisms, and that their use may lead to behavioral disturbances such as dreams and visual hallucinations. They may be used in the management of neurological disorders such as essential tremor, thyrotoxicosis, anxiety, migraine and possibly schizophrenia, and it is these observations which suggest that a cautious approach may be appropriate when impaired central nervous activity is to be avoided. B.B.

N79-11703# School of Aerospace Medicine, Brooks AFB, Tex.

THE PREDICTION OF THE EXISTENCE OR NONEXISTENCE OF CORONARY ARTERY DISEASE USING ROUTINE CLINICAL LABORATORY MEASUREMENT

Raymond G. Troxler, Robert J. Fuchs, Eugene A. Sprague, Martin T. Bailey, John H. Triebwasser, and Emmanuel L. Mosser *In* AGARD Prospective Med. Opportunities in Aerospace Med. Sep. 1978 4 p (For primary document see N79-11692 02-52)

Avail: NTIS HC A05/MF A01

Multivariate analysis shows that plasma cortisol contributes significantly over the above cholesterol and age as a discriminator between those patients with positive coronary arteriograms and patients with negative studies. Data from 57 patients were used to develop a multiple logistic risk function for cholesterol, age, and plasma cortisol. The resulting predictive model demonstrated a predictive value of 86% for a positive test and predictive value of 89% for a negative test. The model was then tested on 78 additional patients who had coronary angiography. The predictive value of a positive test was 91% and the predictive value of a negative test was 78% on the validation group. If further testing continues to validate these findings, it appears that plasma cortisol may be a risk factor for the prediction of coronary artery disease. B.B.

N79-11704# Montefiore Hospital, New York. Inst. for Steroid Research.

COMPARISON OF PLASMA AND URINARY STEROIDS IN MEN WITH TYPE A AND TYPE B BEHAVIOR PATTERNS

Barnett Zumoff, Robert S. Rosenfeld, Meyer Friedman, Sanford O. Byers, Ray H. Rosenman, and Leon Hellman *In* AGARD Prospective Med. Opportunities in Aerospace Med. Sep. 1978 8 p refs Prepared in cooperation with Mount Zion Hospital and Medical Center, San Francisco, Calif. (For primary document see N79-11692 02-52)

Avail: NTIS HC A05/MF A01

A large number of uninary and plasma steroidal parameters were compared in men with Type A and Type B behavior patterns. Two differences were found between these groups: (1)Type A men showed higher daytime (0900-1800)uniary excretion of testosterone glucuronide than Type B men; (2) Type B men showed higher average plasma concentrations of dihydrotestosterone. The results suggest that it may be possible to decrease the risk of coronary heart disease in Type A men by intervening to change the levels or antagonize the effects of certain steroid hormones. B.B.

N79-11705# Advisory Group for Aerospace Research and Development, Paris (France).

SPECIFIC FINDINGS IN CARDIOLOGY AND PULMONARY FUNCTION WITH SPECIAL EMPHASIS ON ASSESSMENT CRITERIA FOR FLYING

M. C. Lancaster, ed. (School of Aerospace Med., Brooks AFB, Tex.) Sep. 1978 170 p refs Presented at Aerospace Med. Panel's 34th Panel Meeting/Specialists Meeting, London, 24-28 Oct. 1977

(AGARD-CP-232; ISBN-92-835-0221-3) Avail: NTIS HC A08/MF A01

Cardiopulmonary disease among military and flight personnel is discussed in terms of premature disability. Data on normal values, natural history, performance of testing methods, assessment of newer techniques for disease detection and definition as well as philosophies of determination of fitness to fly are presented. For individual titles, see N79-11706 through N79-11726.

N79-11706# Centre de Medecine Aeronautique, Brussels (Belgium).

FOLLOW-UP AND TRANSVERSAL STUDY OF VITAL

CAPACITY AND FEV SUB VALUES AMONG PERSONNEL OF THE BELGIAN ARMY FORCES

[illegible] In AGARD Specific Findings in Cardiology and Pulmonary Function with Spec. Emphasis on Assessment Criteria for Flying Sep. 1978 10 p refs Prepared in cooperation with Academisch Ziekenhuis St. Raphael, Leuven, Belgium (For primary document see N79-11705 02-52)
Avail: NTIS HC A08/MF A01

Vital capacity (VC) and one second forced expiratory volume (FEV sub 1) measured in 7123 subjects during annual or biennial medical examinations were analyzed as a function of age (A), weight (W), and standing height (H). The subjects were grouped according to their smoking habits; nonsmokers, light and heavy smokers. Two different studies were performed: a transversal (comparison between subjects) and longitudinal study (comparison within subjects at successive times). The VC and FEV sub 1 were found to increase with age up to 22-23 years; thereafter a steady decline was observed, more pronounced in smokers than in nonsmokers. The decrease with age was more marked in the longitudinal study. In both, longitudinal and transversal surveys, body weight influences the values of VC and FEV sub 1 especially via the cross-products HW, AW, indicating that the effect of weight on the spirometric values varies with age and height. An increase of weight tends to be accompanied with an increase of VC and FEV sub 1 in the younger, taller, and lighter subjects. This effect weakens or even reverses with increasing age and weight, decreasing height, and with heavier smoking (in the longitudinal study). The influence of height on VC and FEV sub 1 appeared to depend more on the cross-product HW, than on H or a power of H, indicating that the effect of height depends markedly on the weight of the subjects, as well in the longitudinal as in the transversal study. Author

N79-11707# Centre d'Essais en Vol, Bretigny-sur-Orge (France).
DETECTION AND SUPERVISION OF OBSTRUCTED RESPIRATORY FLOW IN FLIERS. ADVANTAGES OF DEBIT-VOLUME GRAPHS [DETECTION ET SURVEILLANCE DES TROURCES VENTILATOIRES OBSTRUCTIFS CHEZ LE PERSONNEL NAVIGANT. INTERET DES COURBES DEBIT-VOLUME]
J. Droniou (Hop. d'Instruction des Armees, Clamart, France), H. Vieillefond, and G. Leguay (Hop. d'Instruction des Armees, Versailles) *In* AGARD. Specific Findings in Cardiology and Pulmonary Function with Spec. Emphasis on Assessment Criteria for Flying Sep. 1978 9 p refs In FRENCH (For primary document see N79-11705 02-52)
Avail: NTIS HC A08/MF A01

Because of the multiplication of factors affecting the bronchi, the diagnosis and evaluation of obstructive respiratory flow has importance in the pneumatologic management of flying personnel. Until now, obstructive syndromes were detected by current spirographic practice according to classic parameters measured during forced expiration tests such as the second maximum expiration volume and the volume expired between 75% and 25% of the vital capacity. The recording of debit-volume curves renews interest in forced expiration tests. Maximum expiratory debits measured at low volume are, under certain conditions, independent of effort and reflect the state of the distal bronchi which are rapidly obstructed in chronic obstructive bronch-pneumapathologies. These properties, together with their reproductibility in a given subject, assure to the method an undeniable superiority over classic spirography. The recording of the debit-volume curve is a simple test, well tolerated, then repeated, which requires no complicated equipment.
Trans. by A.R.H.

N79-11708# Naval Aerospace Medical Research Lab., Pensacola, Fla.
LONG TERM PULMONARY FUNCTION PATTERNS IN THE AVIATOR: THE THOUSAND AVIATOR STUDY
Neil R. MacIntyre, Robert E. Mitchell, Albert Oberman, and Ashton Graybiel *In* AGARD. Specific Findings in Cardiology and Pulmonary Function with Spec. Emphasis on Assessment Criteria for Flying Sep. 1978 7 p refs (For primary document see N79-11705 02-52)
Avail: NTIS HC A08/MF A01

Lung function from a 30 year longitudinal study of 622 Naval aviators, all age 52, was analyzed. Age related deterioration in volume spirometry and the prevalence of obstructive lung disease in these subjects compares favorably with other large civilian studies. Military aviation, including the first generation of tactical jet aviation, had no effect on any measured parameters. Cigarette smoking, however, had a marked effect on the prevalence of obstructive lung disease. Even in clinically healthy subjects, cigarette smoking significantly augmented age related deterioration in vital capacity. Smokers who quit early and consumed less than 9100 total packs of cigarettes seemed to be similar to nonsmokers in their risk of disease development and the aging of their lung function. Author

N79-11709# Technische Hochschule, Aachen (West Germany).
MECHANICS OF BREATHING DURING GRADED EXERCISE MEASURED WITH THE BODYPLETHYSMOGRAPH
F. Detering, J. D. Meyer-Erkelenz, H. Sieverts, and S. Effert *In* AGARD. Specific Findings in Cardiology and Pulmonary Function with Spec. Emphasis on Assessment Criteria for Flying Sep. 1978 7 p refs (For primary document see N79-11705 02-52)
Avail: NTIS HC A08/MF A01

Airway resistance, thoracic gas volume, and gas dynamics of breathing of 20 healthy subjects with an average age of 22.6 years were measured during graded exercise with a ventilation system. It was observed, that up to a load of 50 watt the breathing rest position rises in spite of an increase of 66% in the tidal volume and even at 75 watt is still above the initial value. The expiratory reserve volume is called up at a load of 100 watt through an intensified use of the expiratory muscles. The airway resistance increases nearly linear from 2.0 cm H20/1/s at rest to 6/95 cm H20/1/s at 100 watt. J.M.S.

N79-11710# Bundeswehrsanitaetszentrum, Hamburg (West Germany).
STANDARDIZED EXAMINATION METHODS IN ERGOMETRY
J. Prohl *In* AGARD. Specific Findings in Cardiology and Pulmonary Function with Spec. Emphasis on Assessment Criteria for Flying Sep. 1978 8 p (For primary document see N79-11705 02-52)
Avail: NTIS HC A08/MF A01

Standard procedures for ergometry examinations are given along with standard ranges used to compare the measured values with a normal collective. Emphasis is placed on optimum utilization of ergometer stations with an average frequency of 300 examinations per month, while meeting the criteria of (1) simplicity of performance, (2) saving of time, (3) reliability of measurement data, (4) strength of evidence, (5) reproducibility, and (6) comparability of results. J.M.S.

N79-11711# National Defence Medical Centre, Ottawa (Ontario). Cardio-Pulmonary Unit.
CORONARY ATHEROSCLEROSIS AND FITNESS FOR FLYING
Gerald M. Fitzgibbon *In* AGARD. Specific Findings in Cardiology and Pulmonary Function with Spec. Emphasis on Assessment Criteria for Flying Sep. 1978 10 p refs (For primary document see N79-11705 02-52)
Avail: NTIS HC A08/MF A01

Coronary artery disease in flying personnel is considered in terms of the policy of the Canadian Armed Forces that any degree of coronary atherosclerosis is cause for grounding a member of the aircrew. Emphasis is placed on the reliability of various physiological tests - electrocardiogram, Master's two-step test, the treadmill exercise test, and selective coronary angiography in detecting coronary artery disease. J.M.S.

N79-11712# School of Aerospace Medicine, Brooks AFB, Tex.
DETECTION OF CORONARY ARTERY DISEASE IN APPARENTLY HEALTHY ASYMPTOMATIC AIRCREW MEMBERS USING THALLIUM-201 MYOCARDIAL PERFUSION SCINTIGRAPHY
John H. Triebwasser, Thomas Kay, Thomas H. Loecker, Robert Carretta, Gary D. Harris, Roger A. Wolthuis, and Malcolm F. Lancaster *In* AGARD. Specific Findings in Cardiology and Pulmonary Function with Spec. Emphasis on Assessment Criteria for Flying Sep. 1978 6 p refs (For primary document see N79-11705 02-52)
Avail: NTIS HC A08/MF A01

Thallium-201 exercise myocardial perfusion scintigraphy was accomplished in 25 aircrewmembers prior to their undergoing coronary arteriography. Ten patients had ateriographic evidence of obstructive corornary disease. Three had abnormal myocardial scintigrams. One had a borderline abnormal scintigram. Of six patients having normal scintigrams, five had greater than 50% obstruction of one or more vessels. Three of these five had multiple vessel disease. Thirteen of the 15 patients having no arteriographic coronary disease had normal scintigrams. The remaining two had borderline abnormal scans. An abnormal myocradial scintigram was associated with significant obstructive disease. However, a normal scan did not rule out the presence of high grade obstruction. This procedure is of limited value, and cannot replace corornary arteriography as a definitive method for ruling out coronary artery disease in aircrewmembers. J.M.S.

N79-11713# Royal Air Force Central Medical Establishment, London (England).

THE SIGNIFICANCE OF I WAVE ABNORMALITIES

H. B. Kelly *In* AGARD. Specific Findings in Cardiology and Pulmonary Function with Spec. Emphasis or Assessment Criteria for Flying Sep. 1978 4 p refs (For primary document see N79-11705 02-52)

Avail: NTIS HC A08/MF A01

The commonest abnormalities of routine aircrew ECG's to cause concern are those of repolarisation. These men are usually asymptomatic and the evaluation of the ECG abnormality is one of the major problems in the assessment of fitness to fly. Twenty such cases with radiologically normal coronary arteries, and the manner in which the repolarisation abnormalities may be affected by adrenaline, beta adrenergic blockade, and other factors are considered. Author

N79-11714# Centre Principal d'Expertises Medicales du Personnel Navigant, Paris (France).

DIFFICULTIES POSED BY LEFT AXIS DEVIATION IN THE EVALUATION OF FLIERS, AND THEIR RELATIONS TO THE CONCEPT OF LEFT ANTERIOR HEMIBLOCK [LES DIFFICULTES POSEES DANS L'EXPERITSE DU PERSONNEL NAVIGANT PAR LA DEVIATION A GAUCHE DE L'AXE DE QRS ET SES RAPPORTS AVECLE CONCEPT D'HEMIBLOC]

A. Didier and R. Carre *In* AGARD. Specific Findings in Cardiology and Pulmonary Function with Spec. Emphasis on Assessment Criteria for Flying Sep. 1978 12 p refs (For primary document see N79-11705 02-52)

Avail: NTIS HC A08/MF A01

Possible and probable causes of left QRS axis deviation in 60 subjects are discussed. In 34 individuals, previous documentation affirmed the existence of this condition before the age of 25 years as well as its stability over a number of years. This aspect is found at the extreme left of the normal electrocardiogram and the activation of the entire left ventricle is able to depend exclusively on posterior fibers as in left anterior hemiblock. Thus, everything occurs as if the left anterior bundles were barely functioning or not funtioning at all. It is a matter of anonpathological variety of ventricula activation mode. Trans. by A.R.H.

N79-11715# Army Aeromedical Research Lab., Fort Rucker, Ala.

LEFT ANTERIOR HEMIBLOCK (LAH): DIAGNOSIS AND AEROMEDICAL RISK

Frank S. Pettyjohn, Heber D. Jones, Joseph C. Denniston, John C. Kelliher, Lloyd A. Akers, George P. Rice, and James M. Faber *In* AGARD. Specific Findings in Cardiology and Pulmonary Function with Spec. Emphasis on Assessment Criteria for Flying Sep. 1978 6 p refs (For primary document see N79-11705 02-52)

Avail: NTIS HC A08/MF A01

Eighteen US Army initial flight applicants and trained aircrew were evaluated for the electrocardiographic diagnosis of left anterior hemiblock (LAH). This diagnosis was sustained in 50% by the addition of vectorcardiographic criteria. With computer processing and calculation of delay of the intrinsicoid deflection (ID) of the high lateral left ventricular activation time, the diagnosis was sustained in 50% of those records available. Review of the etiology, histopathology, and prognosis indicates difinitive abnormalities of the trifascicular left bundle branch conduction system. Its is essential a complete electrocardiogram (ECG) and vectorcardiogram (VCG) study of military aircrew be obtained to establish the diagnosis of true LAH. The incidence of true LAH is not available but the rarity of this finding with an unknown risk should preclude entry into military flight training. Complete cardiovascular evaluation of the trained airman with acquired LAH should include electrophysiologic studies and selective coronary arteriography and ventriculography prior to consideration for return to full flying duties. Author

N79-11716# Hopital d'Instruction des Armees, Versailles (France).

CARDIAC CONDUCTION AND APTITUDE PROBLEM OF FLIERS. THE BENEFITS OF ENDOCAVITAL RECORDING OF THE His BUNDLES [TROUBLES DE LA CONDUCTION ET APTITUDE AUPERSONNEL NAVIGANT. INNTERET DE L'ENGREGISTREMENT ENDOCAVITAIRE DU FAISCENAU DE His]

G. Leguay, J. C. Duret (Hopital d'Instruction des Armees Percy, Clamart, France), J. Droniou (Service de Cardiologie de l'Armee, France), R. Vettes (Lab. de Med. Aerospatiale), and J. Pernod (Service de Cardiologie de l'Armee, France) *In* AGARD. Specific Findings in Cardiology and Pulmonary Function with Spec. Emphasis on Assessment Criteria for Flying Sep. 1978 9 p refs In FRENCH (For primary document see N79-11705 02-52)

Avail: NTIS HC A08/MF A01

Problems of cardiac conduction can be observed in young subjects with otherwise healthy hearts. The suprahistine localization of the trouble, its vague nature and its functional and reversible character are shown in the endocavital recording of the bundles of His as well as in the oculo-cardiac reflex in both stimulation and pharmaco-dynamic tests. Some of these subjects can recover their physical fitness. However, in addition to data from endocavital recording of the activity of the bundles of His, clinical data and good tolerance in constraint tests must be considered. Trans. by A.R.H.

N79-11717# Centre Principal d'Expertises Medicales du Personnel Navigant, Paris (France).

MEASURING SYSTOLIC TIME INTERVALS AT REST AND UNDER STRESS BY EXTERNAL METHODS. ADVANTAGES IN THE EVALUATION OF FLIERS [MESURES DES INTERVALLES DE TEMPS SYSTOLIQUES PAR METHODES EXTERNES AU REPOS ET A L'EFFORT. INTERET DANS L'EXPERTISE DU PERSONNEL NAVIGANT]

M. Pijoun, F. Plas, and R. Carre *In* AGARD. Specific Findings in Cardiology and Pulmonary Function with Spec. Emphasis on Assessment Criteria for Flying Sep. 1978 13 p refs In FRENCH (For primary document see N79-11705 02-52)

Avail: NTIS HC A08/MF A01

The electromechanical interval and preisometric contraction, the projection interval, the isovolumetric contraction, and the ejection time were measured in 46 subjects at rest and while pedalling a bicycle against a constant force for five minutes. The systolic time at the end of the exercise and during recouperation was measured for 10 minutes. A sensible decrease in the time of isolvumetric contraction and a significant decrease in the ratio of isovolumetric contraction time over ejection time were observed. The value of this ratio as an index of myocardial contraction is discussed, as well as the advantages of mechanographic methods in the examination of flying personnel. The replacement of a carotidogram by a rheographic tracing for a space experiment is described. Trans. by A.R.H.

N79-11718# Hopital d'Instruction des Armees, Versailles (France).

THE ADVANTAGES OF ULTRASONIC ECHOCARDIOGRAPHY IN THE CARDIOLOGICAL EVALUATION OF FLIERS [INTERET DE L'ECHOCARDIOGRAPHIE PAR ULTRASONS DANS L'EXPERTISE CARDIOLOGIQUE DU PERSONNEL NAVIGANT]

J. Droniou (Hopital d'Instruction des Armes Percy, Clamart, France), G. Leguay, J. C. Duret (Service de Cardiologie de l'Armee, France), and J. Pernod (Service de Cardiologie de l'Armee, France) *In* AGARD. Specific Findings in Cardiology and Pulmonary Function with Spec. Emphasis on Assessment Criteria for Flying Sep. 1978 8 p refs In FRENCH (For primary document see N79-11705 02-52)

Avail: NTIS HC A08/MF A01

The principles and techniques of echocardiography are review and the value of this technique in diagnosing obstructive cardiomyopathy, in affirming mitral valve prolapsus in the case of mesosystolic click, and in evaluating myocardial function is assessed. Because of its nontraumatic nature, it is recommended for the cardiological evaluation of flying personnel.

Trans. by A.R.H.

N79-11719# School of Aerospace Medicine, Brooks AFB, Tex. Internal Medicine Branch.

EFFECT OF AGE ON RELAXED +G SUB z TOLERANCE OF AIRCREWMEN

David H. Hull, Roger A. Wolthuis, Kent K. Gillingham, John W. McCracken, and John H. Triebwasser *In* AGARD. Specific Findings in Cardiology and Pulmonary Function with Spec. Emphasis on Assessment Criteria for Flying Sep. 1978 4 p refs (For primary document see N79-11705 02-52)

Avail: NTIS HC A08/MF A01

Healthly aircrewmen from 30 to 55 years old volunteered for a centrifuge study to determine the effect of age on acceleration responses. A visual end-point was used to measure their relaxed tolerance to +Gz forces applied gradually (GORs) and rapidly (RORs). Variability between individual subjects was much more marked with GORs than RORs. Tolerance was higher to the initial GOR than to the second GOR in most subjects. There was a tendency for relaxed G-tolerance to increase with age, but this was statistically significant ($p < .05$) only for initial GORs. These results suggest that healthy middle aged aircrewmen suffer no age related impairment of G-tolerance which would prejudice their fitness to pilot high-performance military aircraft. These results also provide a standard against which to measure the relaxed +Gz tolerance of aircrew with medical disorders, treated and untreated. J.M.S.

N79-11720# School of Aerospace Medicine, Brooks AFB, Tex. Internal Medicine Branch.

REPRODUCIBILITY OF HUMAN CARDIOVASCULAR RESPONSES TO ORTHOSTATIC STRESS

Roger A. Wolthius, David H. Hull, Joseph R. Fisher, and John H. Triebwasser *In* AGARD. Specific Findings in Cardiology and Pulmonary Function with Spec. Emphasis on Assessment Criteria for Flying Sep. 1978 5 p refs (For primary document see N79-11705 02-52)

Avail: NTIS HC A08/MF A01

Orthostatic stress testing was accomplished biweekly on 19 healthy men; each man completed at least eight tests over a period of 16-21 weeks. The test involved 10 minutes of supine rest, followed by 5 minutes of quiet standing against a wall; heart rates and auscultatory blood pressures were recorded on alternate minutes. Variability between tests was similar for all meaurement/protocol condition combinations, indicating that the individual's response to quiet stand and orthostatic change is as variable as his response to supine rest. Further, the range (i.e., 1 SD = 1-9 mmHg or bpm) and magnitude (i.e., 1 SD = approximately 5 mmHg or bpm) of this variability illustrates the need for repeated orthostatic testing when attempting to characterize the typical orthostatic response of a given individual. J.M.S.

N79-11721# Freiburg Univ. (West Germany). Cardiological Centre.

CARDIOLOGICAL FINDINGS IN 115 PILOTS: DIAGNOSES AND ASSESSMENT OF THEIR FLYING FITNESS

Horst H. Renemann, Sabine Koehler, and Herbert Reindell *In* AGARD. Specific Findings in Cardiology and Pulmonary Function with Spec. Emphasis on Assessment Criteria for Flying Sep. 1978 3 p refs (For primary document see N79-11705 02-52)

Avail: NTIS HC A08/MF A01

Results of cardiological examinations of 115 out of 1438 professional and nonprofessional airmen with abnormal or marginal findings in preliminary cardiological examinations are presented. Diagnoses include: (1)24 out of the 115 airmen were found to have isolated ECG alterations without any evidence of organic disease, 22 were relicensed; (2)21 airmen were found to have coronary heart disease, 19 were declared permanently unfit for flight duty and 2 were given a waiver and were required to be re-examined; (3)17 airmen were found to have myocarditis, 2 were declared permanently unfit for flight duty and 15 were relicensed after successful treatment; (4)15 were shown to have pseudoangina pectoris, 1 was declared permanently unfit for flight duty due to chronic psychic liability; and (5) 11 were shown to have hypotensive disturbances of blood pressure and were advised to undergo intensive sports therapy, 1 was declared permanently unfit for flight duty. J.M.S.

N79-11722# Centro di Studi e Ricerche di Medicina Aeronautica e Spaziale, Rome (Italy).

NORMAL AND PATHOLOGICAL CARDIOVASCULAR FINDINGS IN APPLICANTS TO THE AIR FORCE SERVICE

C. A. Ramacci and P. Rota *In* AGARD. Specific Findings in Cardiology and Pulmonary Function with Spec. Emphasis on Assessment Criteria for Flying Sep. 1978 6 p refs (For primary document see N79-11705 02-52)

Avail: NTIS HC A08/MF A01

Data resulting from the medical and instrumental examinations of 1000 subjects are considered. Tests conducted include humeral arterial blood pressure control, electrocardiographic registration, and X-ray screening of the thorax. Data are discussed in terms of risk indicators. J.M.S.

N79-11723# Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio.

EVALUATION OF CARDIAC RISK AND SUBJECT RESPONSE TO AMELIORATIVE EFFORTS

Roy L. DeHart *In* AGARD. Specific Findings in Cardiology and Pulmonary Function with Spec. Emphasis on Assessment Criteria for Flying Sep. 1978 8 p refs (For primary document see N79-11705 02-52)

Avail: NTIS HC A08/MF A01

A group of mid-level military and civilian personnel attending a senior service school was provided the opportunity to participate in a cardiac risk evaluation program. Following the evaluation, each participant was provided an individual prescription for health sugggesting methods for reducing factors with excesssive risk through life style alterations. The risk factors assessed included familiy cardiac history, obesity, smoking, pulmonary function, blood pressure, blood lipids, and physical fitness. The assessment was conducted in three stages: historical review of medical records and by questionnaire, blood chemistry and enzyme screen, physical examination and indirect determination of aerobic power. A follow-on survey was distributed to the student body and faculty three years following the initial cardiac risk assessment. Both program participants and nonparticipants were requested to complete and return the survey form. The survey evaluated the individual's perception of his current health, life style changes which may alter cardiac risk, and factors influencing the individual's decision to reduce or ignore risk. The results of this survey are presented and their implications for military prospective medicine programs discussed. J.M.S.

N79-11724# Civil Aviation Authority, London (England).

THE IMPACT OF CORONARY VASCULAR RISK FACTORS ON PROFESSIONAL AIRCREW LICENSE LOSS IN THE UNITED KINGDOM

Michael Joy *In* AGARD. Specific Findings in Cardiology and Pulmonary Function with Spec. Emphasis on Assessment Criteria for Flying Sep. 1978 6 p refs (For primary document see N79-11705 02-52)

Avail: NTIS HC A08/MF A01

The causes of license loss in UK professional aircrew were studied. Results indicate that nearly 60% are lost due to cardiovascular causes. It is suggested that preventative medicine and not more rigorous screening is the sensible approach to a reduction of flight deck incapacitation from cardiovascular causes. J.M.S.

N79-11725# Italian Air Force Medical Service H. Q., Rome.

CARDIOVASCULAR DISEASES AS A CAUSE OF UNFITNESS FOR FLYING SERVICE IN AIRCREWS OF ITALIAN AIR FORCE: ETIOPATHOGENESIS, INFLUENCE OF PERFORMANCE IN FLIGHT, AND PREVENTION

Gaetano Rotondo *In* AGARD. Specific Findings in Cardiology and Pulmonary Function with Spec. Emphasis on Assessment Criteria for Flying Sep. 1978 7 p refs (For primary document see N79-11705 02-52)

Avail: NTIS HC A08/MF A01

Cardiac arteriosclerotic and degenerative diseases, arterial hypertension, the diseases including functional cardiac disorders, acute and chronic rheumatic cardiopathies are cited as causes of unfitness for flight duty. An evaluation and interpretation is made of possible causes of the high inhabilitating incidence of cardiovascular diseases, and in particular of arteriosclerosis, in provoking unfitness to flying duty among aircrews, and in influencing the military performance in flight. Preventive and predictive measures are also taken into consideration. Conclusive deductions emphasize the adviability of attempting to improve and refine methods adoped in diagnosing early signs of atherosclerotic disease in flying personnel, particularly after the age of 40, as well as the opportunity of researching major risk factors. This task could be achieved mainly by means of a periodical executiona nd correct evaluation of the tests which are recognized as useful for the early diagnosis of atherosclerosis and of the most important cardiovascular diseases. J.M.S.

N79-11726# Civil Aviation Authority, London (England). Medical Dept.

CARDIOVASCULAR FITNESS OF PILOTS OF TRANSPORT AIRCRAFT

C. Bennett In AGARD Specific Findings in Cardiology and Pulmonary Function with Spec. Emphasis on Assessment Criteria for Flying Sep. 1978 4 p refs primary document see N79-11705 02-52)

Avail: NTIS HC A08/MF A01

Cardiovascular disease is discussed in terms of threatening safety in civil two-pilot transport operations. Improvements in medical screening to reduce the already low risk of in-flight incidents and better operational training and control measures to prevent the cardiovascular incidents from becoming accidents are among the topics covered. J.M.S.

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N79-11727# National Aviation Facilities Experimental Center, Atlantic City, N. J.

DEVELOPMENT OF A PERFORMANCE CRITERION FOR AIR TRAFFIC PERSONNEL RESEARCH THROUGH AIR TRAFFIC CONTROL SIMULATION Final Report, Jan. 1975 - Oct. 1977

Edward P. Buckley, Kenneth House, and Richard Rood Jul. 1978 99 p refs

(FAA Proj. 216-101-100)

(AD-A058082; FAA-NA-78-9; FAA-RD-78-71) Avail: NTIS HC A05/MF A01 CSCL 05/9

Objective measurement of the radar control performance of air traffic controllers by means of air traffic control simulation exercises was investigated. A set of objective measurements developed for the NAFEC Air Traffic Control Simulation Facitlity is described. The relevance of this measurement technique for either evaluating new systems (when the same or similar controller teams are functioning) or for evaluating various controller individuals or teams (when they are using the same system control traffic) is discussed. Other applications are also described. The ability of the simulator to repeatedly present the same traffic samples is stressed as a means of accumulating comparable and normative data. The need for basic experimentation for validation of the test measurement system and to develop further knowledge and understanding of the measurements is recognized. A relatively small keystone experimantal design is described and recommended as the first essential step for all possible applications. The availability of adequate numbers of controllers as subjects is recognized as the major problem to be overcome. Development of a means for transmitting tests originating in NAFEC'S simulator to field sites is recommended. S.B.S.

N79-11728# Dunlap and Associates, Inc., La Jolla, Calif.

A7 TRAINING EFFECTIVENESS THROUGH PERFORMANCE ANALYSIS Final Report, Apr. 1975 - Dec. 1977

Clyde A. Brictson Apr. 1978 64 p refs

(Contract N61339-75-C-0105)

(AD-A056230; NAVTRAEQUIPC-75-C-0105-1) Avail: NTIS HC A04/MF A01 CSCL 05/9

Training concepts which emphasize landing performance analysis, diagnostic feedback and remedial instruction for novice A7 pilots are described. FCLP performance is analyzed to identify low performers who are potential recycle trainees. A Night Carrier Landing Trainer (NCLT) provides individualized remedial training to improve eventual carrier landing performance. Results of a field test of the method are presented. Fleet performance of previous recycle trainees is reviewed and discussed along with recommendations for training implementation.Author (GRA)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N79-11729*# National Aeronautics and Space Administration, Washington, D. C.

THE COSMONAUT IN FLIGHT

P. I. Klimuk and Ye. B. Baburina Apr. 1977 21 p Transl. into ENGLISH from Zdorovye (USSR), no. 4, 1976 p 6-9; no. 6, 1976 p 6-7; no. 7, 1976 p 6-7 Transl. by Sci. Transl. Serv., Santa Barbara, Calif.

(Contract NASw-2791)

(NASA-TT-F-17438) Copyright. Avail: NTIS HC A02/MF A01 CSCL 05H

The unusual conditions under which cosmonauts work and live are described. The problems of weightlessness are analyzed. A description is given of a day spent by a cosmonaut on the Salyut-4 orbital manned space station. The exercise regime, food program, and scientific experiments are discussed. Observations of other planets from spacecraft are described and the growth and operation of a hydroponic vegetable garden is discussed by a cosmonaut. Author

N79-11730*# Stanford Research Inst., Menlo Park, Calif.

DEVELOPMENT OF TECHNIQUES TO ENHANCE MAN/MACHINE COMMUNICATION Final Report

Russell Targ, Phyllis Cole, and Harold Puthoff Aug. 1974 70 p refs

(Contracts NAS7-100; JPL-953653; SRI Proj. 2613)

(NASA-CR-157886) Avail: NTIS HC A04/MF A01 CSCL 05H

A four-state random stimulus generator, considered to function as an ESP teaching machine was used to investigate an approach to facilitating interactions between man and machines. A subject tries to guess in which of four states the machine is. The machine offers the user feedback and reinforcement as to the correctness of his choice. Using this machine, 148 volunteer subjects were screened under various protocols. Several whose learning slope and/or mean score departed significantly from chance expectation were identified. Direct physiological evidence of perception of remote stimuli not presented to any known sense of the percipient using electroencephalographic (EEG) output when a light was flashed in a distant room was also studied. S.B.S.

N79-11731*# Martin Marietta Corp., Denver, Colo.

SPACECRAFT UTENSIL/HAND CLEANSING FIXTURE Final Report

T. G. Jonkoniec Oct. 1978 132 p

(Contract NAS9-15012)

(NASA-CR-151845; MCR-78-618) Avail: NTIS HC A07/MF A01 CSCL 06K

A fixture which provides a means for a crewman to perform, in zero gravity, laboratory utensil/tool cleansing and personal hygiene functions such as handwashing, shaving, body wash, and teeth brushing is described. A prototype unit developed incorporating design improvements resulting from breadboard tests in a one gravity and zero gravity environment demonstrated the capability of performing the different cleansing functions. J.M.S.

N79-11732*# Martin Marietta Corp., Denver, Colo.
SPACECRAFT UTENSIL/HAND CLEANSING FIXTURE, ADDENDUM Final Report
T. G. Jonkoniec Oct. 1978 125 p
(Contract NAS9-15012)
(NASA-CR-151846; MCR-78-618-Add) Avail: NTIS HC A06/MF A01 CSCL 06K

Engineering drawings and component spec sheets used in the fabrication of the prototype spacecraft utensil/hand cleaning fixture are presented. J.M.S.

N79-11733*# Umpqua Research Co., Myrtle Creek, Ore.
WATER SYSTEM MICROBIAL CHECK VALVE DEVELOPMENT Final Report
Gerald V. Colombo, Dale R. Greenley, and David F. Putnam Jul. 1978 53 p
(Contract NAS9-15079)
(NASA-CR-151843; URC-80708) Avail: NTIS HC A04/MF A01 CSCL 06K

A residual iodine microbial check valve (RIMCV) assembly was developed and tested. The assembly is designed to be used in the space shuttle potable water system. The RIMCV is based on an anion exchange resin that is supersaturated with an iodine solution. This system causes a residual to be present in the effluent water which provides continuing bactericidal action. A flight prototype design was finalized and five units were manufactured and delivered. S.B.S.

N79-11734*# Webb Associates, Yellow Springs, Ohio.
ANTHROPOMETRIC SOURCE BOOK. VOLUME 1: ANTHROPOMETRY FOR DESIGNERS
Edmund Churchill, comp., Lloyd L. Laubach, comp., John T. McConville, comp, and Ilse Tebbetts, comp. Houston, Tex. NASA Jul. 1978 603 p refs
(NASA-RP-1024; S-479) Avail: NTIS HC A99/MF A01 CSCL 05H

All the basic areas of anthropometry and its applications to the design of clothing, equipment, and workspaces for manned space flight are presented. For individual titles, see N79-11735 through N79-11743.

N79-11735*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
ANTHROPOMETRIC CHANGES IN WEIGHTLESSNESS
William Thornton *In* Webb Assoc. Anthropometric Source Book, Vol. 1 Jul. 1978 105 p refs (For primary document see N79-11734 02-54)
Avail: NTIS HC A99/MF A01 CSCL 05H

Weight loss, height increases, neutral body posture, strength and body composition, changes in trunk and limb girth, and loss of muscle mass in a weightless environment are discussed. Where possible, explanations of physiological mechanisms are included. Data from the Skylab missions, Apollo-Soyuz Test Project mission, and the Russian space program are presented. Potential applications to space-related problems are also included. S.B.S.

N79-11736*# Webb Associates, Yellow Springs, Ohio.
VARIABILITY IN HUMAN BODY SIZE
James F. Annis *In its* Anthropometric Source Book, Vol. 1 Jul. 1978 63 p refs (For primary document see N79-11734 02-54)
Avail: NTIS HC A99/MF A01 CSCL 06P

The range of variability found among homogeneous groups is described and illustrated. Those trends that show significantly marked differences between sexes and among a number of racial/ethnic groups are also presented. Causes of human-body size variability discussed include genetic endowment, aging, nutrition, protective garments, and occupation. The information is presented to aid design engineers of space flight hardware and equipment. S.B.S.

N79-11737*# Webb Associates, Yellow Springs, Ohio.
ANTHROPOMETRY
John T. McConville and Lloyd L. Laubach *In its* Anthropometric Source Book, Vol. 1 Jul. 1978 106 p refs (For primary document see N79-11734 02-54)
Avail: NTIS HC A99/MF A01 CSCL 05H

Data on body-size measurement are presented to aid in spacecraft design. Tabulated dimensional anthropometric data on 59 variables for 12 selected populations are given. The variables chosen were those judged most relevant to the manned space program. A glossary of anatomical and anthropometric terms is included. Selected body dimensions of males and females from the potential astronaut population projected to the 1980-1990 time frame are given. Illustrations of drawing-board manikins based on those anticipated body sizes are included. S.B.S.

N79-11738*# Michigan Univ., Ann Arbor.
THE INERTIAL PROPERTIES OF THE BODY AND ITS SEGMENTS
Herbert M. Reynolds *In* Webb Assoc. Anthropometric Source Book, Vol. 1 Jul. 1978 76 p refs (For primary document see N79-11734 02-54)
Avail: NTIS HC A99/MF A01 CSCL 06P

Mass distribution properties of the adult human body are summarized. The summary is user-oriented for design engineers and mathematical modeling. Properties are dicussed in terms of the musculoskeletal linkage system, axes systems, mass, volume, center of mass, and inertial properties. Data and prediction equations or coefficients for modeling these properties are provided. Predictive formulas use total body weight and stature as independent variables. The data are based on small samples of living and cadaveric subjects typical of the white European male. S.B.S.

N79-11739*# Michigan State Univ., East Lansing.
ARM-LEG REACH AND WORKSPACE LAYOUT
Howard W. Stoudt *In* Webb Assoc. Anthropometric Source Book, Vol. 1 Jul. 1978 68 p refs (For primary document see N79-11734 02-54)
Avail: NTIS HC A99/MF A01 CSCL 05H

Information on functional reach measurements relevant to the design and layout of workspaces in the Space Shuttle and Spacelab programs is presented. Basic reach data are given, along with recommendations for applying corrective factors to adjust for differences in (1) workspace, task, and body position; (2) environmental conditions (primarily gravity forces); and (3) anthropometric characteristics of various populations. S.E.S.

N79-11740*# Webb Associates, Yellow Springs, Ohio.
RANGE OF JOINT MOTION
Lloyd L. Laubach *In its* Anthropometric Source Book, Vol. 1 Jul. 1978 20 p refs (For primary document see N79-11734 02-54)
Avail: NTIS HC A99/MF A01 CSCL 06P

An assessment of body mobility is presented. The information that is discussed includes the following; (1) selected reviews of the range of joint motion literature; (2) range of joint motion terminology; (3) techniques for measuring range of joint motion; (4) recommended range of joint motion data for the design engineer; (5) differences in range of joint motion due to the effects of age; (6) differences in the range of joint motion between men and women; (7) the assessment of differences in range of joint motion caused by protective coating; and (8) the range of joint motion of selected two-joint muscles. S.E.S.

N79-11741*# Webb Associates, Yellow Springs, Ohio.
HUMAN MUSCULAR STRENGTH
Lloyd L. Laubach *In its* Anthropometric Source Book, Vol. 1 Jul. 1978 55 p refs (For primary document see N79-11734 02-54)
Avail: NTIS HC A99/MF A01 CSCL 06P

Human muscle strength for the guidance of design engineers in dealing with a large volume of contradictory strength data is studied. Encompassing a widely variable population, the following topics are discussed; (1) a general review of human muscular strength; (2) specificity of muscular strength; (3) relationships between static and dynamic muscular strength; (4) strength within the arm reach envelope of the seated subject; and comparative muscular strength of men and women. S.E.S.

N79-11742*# Webb Associates, Yellow Springs, Ohio.
ANTHROPOMETRY IN SIZING AND DESIGN
John T. McConville *In its* Anthropometric Source Book, Vol. 1 Jul. 1978 22 p refs (For primary document see N79-11734 02-54)

Avail: NTIS HC A99/MF A01 CSCL 05H

The application of human body-size diversity and quantification to engineering design is discussed. The following procedures are outlined for using anthropometric data in the development of effective sizing programs: (1) selection of the appropriate data; (2) selection of the key sizing dimensions; (3) selection of intervals for the key dimensions; (4) development of dimensional data for each sizing category; (5) conversion of summary data to appropriate design values; (6) preparation of a tariff; (7) establishing what the equipment must do for the operator.S.E.S.

N79-11743*# Webb Associates, Yellow Springs, Ohio.
STATISTICAL CONSIDERATIONS IN MAN-MACHINE DESIGNS
Edmund Churchill *In its* Anthropometric Source Book, Vol. 1 Jul. 1978 63 p refs (For primary document see N79-11734 02-54)
Avail: NTIS HC A99/MF A01 CSCL 05H

The statistical concepts of man-machine designs that appear repeatedly in the NASA Anthropometric Source Book are reviewed. Some statistical problems that confront the users are discussed. The averages, measures of variability, and percentiles of basic univariate statistical measures are defined. The relationship between percentiles and mean-standard deviations are explored and tables detailing this relationship are presented. S.E.S.

N79-11744# Human Engineering Labs., Aberdeen Proving Ground, Md.
INTERNAL COCKPIT REFLECTIONS OF EXTERNAL POINT LIGHT SOURCES FOR THE MODEL YAH-64 ADVANCED ATTACK HELICOPTER
Christopher C. Smyth Jun. 1978 16 p refs
(AD-A056489) Avail: NTIS HC A02/MF A01 CSCL 01/3

The US Army Human Engineering Laboratory (HEL) has developed a computer program for computing internal cockpit reflections on the transparent canopy surfaces of external point light sources. This work is part of a three-stage effort to determine optimum canopy designs for the Model 209 AH-1S Cobra Helicopter and the Model YAH-64 Advanced Attack Helicopter (AAH). The low glare canopy design presently used on both models consists of flat, transparent panels on the front surfaces and simple cylindrical panels on the sides and top. The design is a reasonable choice for reducing both solar glint to outside observers during daytime operations and internal reflections of outside light sources during nighttime operations. This work effort is directed toward a closer study of the two problems of glint and reflections, and developing an optimum design for the canopy's transparent surfaces. GRA

N79-11745# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
SPEECH QUALITY MEASUREMENT
T. P. Barnwell, III, A. M. Bush, R. M. Mersereau, and R. W. Schaffer May 1978 177 p refs
(Contract F30602-75-C-0118; AF Proj. 9567)
(AD-A056272; RADC-TR-78-122) Avail: NTIS HC A09/MF A01 CSCL 17/2

Speech quality measurement--in terms of user acceptability--is considered from 3 points of view: subjective testing, objective testing, and communicability testing. It is assumed that good intelligibility is always present. Subjective testing is considered from the perspective of isopreference, relative preference, and absolute-preference, with isometric and parametric test methodologies, with the results of PARM and QUART as a basis. It is felt that the best approach for future subjective testing will be a parametric approach using representative male and female talkers to cover the expected range of pitch. Objective testing is considered as a possible alternative to subjective testing. A two part experimental study of the relationship between a number of objective measures and the subjective acceptability measures available from the PARM study is described. In the communicability test, the user is expected to perform on the data some cognitive task which is measurable. The rationale is that the user will be better able to perform if the quality is high, than if his cognitive resource, assumed fixed, is saturated due to poorer quality transmission. GRA

N79-11746# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
STUDY OF CREW TASK LOADING ON THE C-141A AIRCRAFT Final Report, Mar. - Jun. 1977
Richard J. Schiffler, Richard Geiselhart, and John C. Griffin Apr. 1978 74 p refs
(AD-A057346; ASD-TR-78-3) Avail: NTIS HC A04/MF A01 CSCL 05/9

The objective of the study was to determine the feasibility of a four-man crew consisting of two pilots, a flight engineer and a Flight System Operator, to fly C-141 missions. The test results indicated that the airland mission can be accomplished with a four-man crew. Presently for a combat airlift mission (airdrop) the most optimal crew composition would be two pilots, navigator and flight engineer. With additional training, it might be feasible to substitute a Flight Systems Operator for navigator in the combat airlift mission. GRA

N79-11747# Naval Air Development Center, Warminster, Pa. Aircraft and Crew Systems Technology Directorate.
LASER EYE PROTECTION FOR FLIGHT PERSONNEL, VOLUME 1
Gloria Twine Chisum 13 Jul. 1978 16 p refs
(AD-A057417; NADC-78158-60-Vol-1) Avail: NTIS HC A02/MF A01 CSCL 06/18

Developments in laser technology have resulted in an expanding use of lasers in many fields and laboratory situations. The implications of the use of lasers in military applications have been examined for flight personnel, and the requirement for eye protection determined. Recommendations for methods of providing that protection are made. Author (GRA)

N79-11748# Sandia Labs., Albuquerque, N. Mex.
EFFECT OF IMPERMEABLE CLOTHING AND RESPIRATOR ON WORK PERFORMANCE. PART 1: LABORATORY STUDIES
P. B. Mossman and H. A. Atterbom (N. Mex. Univ., Albuquerque) Apr. 1978 47 p refs
(SAND-77-2132) Avail: NTIS HC A03/MF A01

Work performance with impervious clothing and full-face respirator was investigated during maximal and submaximal (40 to 60 percent) bicycle ergometer efforts. Five different exercise protocols were administered. Heart rate (HR), oxygen consumption (V/sub O2/), and skin and rectal temperatures (T/sub s/ and T/sub r/) were monitored. The impervious suits resulted in decreased work performance, aerobic metabolism, and tolerance time. Stress indices of HR and mean T/sub s/ were found to be correlated with these differences. The study demonstrates that a security system using a chemical deterrent places a physiological stress of considerable magnitude on an adversary group. D.O.E.

N79-11659*# Louisville Univ., Ky. Dept. of Anatomy.
KILLFISH DEVELOPMENT IN ZERO-G ON COSMOS 782: FUNDULUS EXPERIMENT K-104 Final Report
J. R. Keefe, H. W. Scheld (Houston Univ., Tex.), J. F. Boyd (Northrop Serv., Inc., Houston, Tex.), P. M. Fuller, and J. M. Oppenheimer (Bryn Mawr Coll., Penn.) *In* NASA. Ames Res. Center US Expt. Flown on the Soviet Satellite COSMOS 782 Sep. 1978 p 179-199 refs (For primary document see N79-11651 02-51)
Avail: NTIS HC A18/MF A01 CSCL 06C

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.
For components see *33 Electronics and Electrical Engineering.*

N79-11749 Yale Univ., New Haven, Conn.
A MULTIPROCESSOR ARCHITECTURE FOR LARGE NUMERICAL PROBLEMS Ph.D. Thesis
Inder Mohan Singh 1977 306 p
Avail: Univ. Microfilms Order No. 7818099

The design of a multiprocessor architecture for large numerical problems in areas such as image-processing is described. The characteristics of the typical problems are discussed and possible alternative approaches are surveyed. The system design offers a significant price-performance advantage over existing high-performance computers. Software considerations are discussed and an approach to system software is described, which utilizes existing software extensively. The cost and performance of the system are analyzed, using examples of typical computations.
Dissert. Abstr.

N79-11750*# National Aeronautics and Space Administration, Washington, D. C.
THE ORGANIZATION OF COMMUNICATIONS OF THE YeS COMPUTER AND THE M-60000 COMPUTER
N. N. Bugayev, Ye. D. Gernet, V. V. Gorodilov, G. G. Dogadko, G. I. Zabiyakin, V. M. Kostelyanskiy, K. A. Larionov, O. F. Pozhiltsov, A. Ye. Rozenberg, and S. N. Rykovanov Oct. 1976 34 p refs Transl. into ENGLISH of "Organizatsiya Svyazi Vychislitelnykh Mashin ES EVM M-6000", Rept. PR-259 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1976 p 1-31 Transl. by Transemantics, Inc., Washington, D. C.
(Contract NASw-2792)
(NASA-TT-F-17270; PR-259) Avail: NTIS HC A03/MF A01 CSCL 09B

In the work a description is given of one of the possible methods of organizing communication of the YeS and the M-6000 computers, linked via the input-output interface matcher. A characteristic feature of the described variation of organizing computer linkage is the use of standard software for functioning of the computer complex. This is the OS YeS (with the graphic access method) with respect to the YeS computer and the OUS, including a matcher driver for the M-6000. Connecting the M-6000 to the YeS computer is described; exchange commands, bytes of state and bytes of refined state and their purpose are indicated. Author

N79-11751# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
SYSTEM FOR CONTROLLING DATA ACQUISITION AND TRANSMISSION UTILIZING MICRO-COMPUTERS [SISTEMA DE CONTROLE, AQUISICAO E TRANSMISSAO DE DADOS UTILIZANDO MICRO-COMPUTADOR]
Genesio Luiz Hubscher Sep. 1978 107 p refs In PORTUGUESE; ENGLISH summary
(INPE-1354-TPT/101) Avail: NTIS HC A06/MF A01

The development of a microcomputer-controlled data acquisition and position control system for a balloon-borne radiation detector, for the study of staremiteed radiation is described. Temperature and pressure sensors, which will also feed data to the microcomputer is included in the onboard acquisition system. A communications channel between ground telemetering station and the microcomputer is described, which will allow the reception and transmission of information and commands which the microcomputer will process and execute.
S.E.S.

N79-11752# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Sciences.
HARP: A LOW-COST 25 MIPS DIGITAL PROCESSOR Interim Report
Stan Kriz, Raj Reddy, Brian Rosen, Steven Rubin, and Steve Saunders 25 Feb. 1978 22 p refs
(Contract F44620-73-C-0074; ARPA Order 2466)
(AD-A056070; CMU-CS-78-106; AFOSR-78-1090TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

Harp is an ultra-high performance processor motivated by the low-level processing requirements of machine perception tasks. It is designed for extreme speed, low cost, easy producibility, simplicity of structure and programming, and complete diagnosability. This paper discusses the design philosophy, architecture, instruction set, and performance of Harp. Author (GRA)

N79-11753# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
MODULARIZATION AND HIERARCHY IN A FAMILY OF OPERATING SYSTEMS
A. N. Habermann, Lawrence Flon, Lee Cooprider, Peter Feiler, and Loretta Guarino Feb. 1978 28 p refs
(Contract F44620-73-C-0074; Grant NSF DCR-74-24573; ARPA Order 2466)
(AD-A056069; CMU-CS-78-101; AFOSR-78-1089TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

The objective of the Family of Operating Systems project has been to investigate the feasibility of constructing systems which use identical or similar resources and share basic design decisions. The concepts of module, address space and hierarchy have been used with special care. Common to all family members is the virtual memory facility which controls dynamic address space transitions. Family members may differ in the facilities they provide in static address spaces. This report presents an overall description of the FAMOS system. Section 1 describes the basic ideas underlying the FAMSO system and Section 2 describes the implementation. A more detailed description is found in the official documentation of the FAMOS system. This documentation consists of a number of module documents. Each module document comprises two parts, an introductory description which specifies the function and dependency of a module and a type description which defines the representation and implementation of a module as static address space. Author (GRA)

N79-11754# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
A SURVEY AND CRITIQUE OF SOME MODELS OF CODE GENERATION Interim Report
R. G. G. Cattell Nov. 1977 21 p refs
(Contract F44620-73-C-0074; ARPA Order 2455; AF Proj. 2466)
(AD-A056027; AFOSR-78-1084TR) Avail: NTIS HC A02/MF A01 CSCL 09/2

Various work on code generation is discussed, particularly from the point of view of simplifying and/or automating the derivation of this phase of compilers. Code generators, which typically translate an intermediate notation into target machine code in one or more steps, have been relatively ad hoc as compared to the first phase of compilers, which translates a source language into the intermediate notation. Progress in formalizing the code generation process is summarized, with the conclusion that considerably more work remains. Future directions of research are suggested. Author (GRA)

N79-11755# Massachusetts Inst. of Tech., Cambridge. Dept. of Mathematics.
GRAPHICAL REPRESENTATIONS AS A DISCIPLINE
Herman Chernoff 12 Apr. 1978 27 p refs
(Contract N00014-75-C-0555)
(AD-A056633; TR-11) Avail: NTIS HC A03/MF A01 CSCL 12/1

In recent years, partly as a result of the computer revolution,

the use of graphical representations in statistics is beginning to attract more attention. It seems appropriate to develop a discipline for such graphical representations. It is proposed that one way to develop such a discipline is to compile a list of functions and attributes on which each graphical method would be scaled and on which each potential application would also be scaled. For each application, the appropriate method could be selected by how well it matches the application in these attribute scales. Several representations of multivariate data including profiles, stars, faces and Andrews' Fourier Series are used as illustrations. Author (GRA)

N79-11756# Illinois Univ. at Urbana-Champaign, Urbana. Coordinated Science Lab.

STEPS INTO COMPUTATIONAL GEOMETRY: NOTEBOOK 2

F. P. Preparata, ed. Sep. 1977 29 p refs

(Contract DAAB07-72-C-0259; Grant NSF MCS-76-17321)

(AD-A056271; R-792; UILU-ENG-77-2239) Avail: NTIS HC A03/MF A01 CSCL 12/1

In this notebook a collection of new results is presented in computational geometry, which all concern problems of planar geometry. The first problem is that of triangulating a simple n-vertex polygon; we show that this can be done in time O(nlogn), by first decomposing in time O(nlogn) the given polygon into a collection of special polygons, called monotone, which can be individually triangulated in time proportional to their numbers of edges. The second result concerns that all-nearest neighbor problem for an n-vertex polygon: a surprising result is that, also no method faster than O(nlogn) is known for constructing the Voronoi diagram of a convex polygon, the all-nearest-neighbor problem can be solved in time O(n). Finally, we show the feasibility of an optimal real-time algorithm for constructing the convex hull of a set of n points in the plane. This algorithm constructs the hull by successive updates, using total O(nlogn) time - which is optimal - with an interpoint delay O(logn), which gives the real-time property. Author (GRA)

N79-11757# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

SPECIFICATIONS FOR THE INTERCONNECTION OF A HOST AND AN IMP (INTERFACE MESSAGE PROCESSOR)

May 1978 231 p Revised

(Contract DCA200-77-C-0616)

(AD-A055996; BBN-1822-Rev-78) Avail: NTIS HC A11/MF A01 CSCL 09/2

The ARPA computer network permits large, dissimilar, geographically separated computers, called Hosts, to communicate with each other. One or more Hosts can be connected to a local Interface Message (imp), which transmits messages from its Host(s) to other Hosts and accepts messages for its Host(s) from other Hosts. There need be no direct communication circuit between a given pair of Hosts; in such cases intermediate IMPs act as message switchers. The message switching is performed as a store and forward operation. The Terminal IMP (TIP), which consists of an IMP and a Multi-Line Controller (MLC), extends the network concepts by permitting the direct attachment (without an intervening Host) of up to 63 dissimilar terminal devices to the network. This document provides detailed specifications of the electrical and logical characteristics of the interface which a Host must provide for attachment to an IMP or TIP. In addition, it specifies the formats of message which a Host may send across this interface into the network or which the Host must be prepared to receive from the network. These messages may be directed to/from other Hosts, the local IMP, or (under certain conditions) programs which monitor the network performance at any IMP. Author (GRA)

N79-11758# Pennsylvania Univ., Philadelphia. Dept of Decision Science.

DBLISP: A SEED/LISP INTERFACE USERS MANUAL

Ronald M. Lee Feb. 1978 16 p refs

(AD-A057320; Rept-78-02-04) Avail: NTIS HC A02/MF A01 CSCL 09/2

DBLISP consists of a set of functions which provide a direct interface between the SEED network database system (version B04) and UCI LISP. Described here are instructions for using DBLISP, a sample session and various technical comments. Author (GRA)

N79-11759# Pennsylvania Univ., Philadelphia. Dept. of Decision Sciences.

DYNAMIC TECHNIQUES FOR RESTRUCTURING THE CONCEPTUAL SCHEMA - AN IMPLEMENTATION M.S. Thesis

Edward Nevin Beaver May 1977 69 p refs

(Contract N00014-75-C-0462)

(AD-A057318; Rept-77-06-02) Avail: NTIS HC A04/MF A01 CSCL 09/2

This work is a partial implementation of a dynamic restructuring processor. The total dynamic restructuring processor allows several generations of database structure to coexist. Restructuring occurs incrementally as data is accessed in the database. Only restructuring of the conceptual schema (as defined by the ANSI/SPARC report) is considered on a CODASYL type database system called WAND. The implementation uses generation data structures which allow several related schemas and databases to coexist with proper restructuring translation done on the fly. The scope of this implementation includes an analysis of data requirements and general implementation strategy for the total processor and detailed design and programming of routines that provide run-time translation from one schema definition and associated database to a user using another but related schema definition. Author (GRA)

N79-11760# Los Alamos Scientific Lab., N. Mex.

LARGE-SCALE SCIENTIFIC COMPUTATION AT THE LOS ALAMOS SCIENTIFIC LABORATORY

B. L. Buzbee Jun. 1978 16 p refs

(Contract W-7405-eng-36)

(LA-7258-MS) Avail: NTIS HC A02/MF A01

The text of a talk given at the 1977 fall meeting of the Society for Industrial and Applied Mathematics is reported. Performance and architectural trends in supercomputers are surveyed, and various aspects of the large-scale numerical simulation process affecting computational facilities are described. Plans for utilizing the CRAY-1 computer as well as other future supercomputers, are discussed. Speculations about how numerical analysis may be affected by current trends in supercomputers are given. DOE

N79-11761# Federal Computer Performance Evaluation Simulation Center, Washington, D. C.

COMPUTER SCIENCE AND TECHNOLOGY: UNIVAC 1108 EXEC LEVEL 32R2 PERFORMANCE HANDBOOK Final Report

John C. Kelly and Gary P. Route NBS Jun. 1978 147 p Sponsored in part by Army

(PB-283153/5; NBS-SP-500-34; LC-78-600054) Avail: NTIS HC A07/MF A01 CSCL 09B

A set of hypotheses is described for evaluating the performance of UNIVAC 1100 Computer Systems. The hypotheses specifically apply to EXEC level 32R2 operating on UNIVAC 1108 Computer Systems. Attempts to apply the quidelines to different UNIVAC 1100 models or to different levels of the EXEC may lead to erroneous results. The report contains sections on each major complex within the EXEC. Each section (1)states the performance hypotheses associated with that complex,(2)explains how the available measurement tools may be used to determine if the hypotheses are true, and (3) identifies which performance parameters need to be changed to correct the problem situation. All of the performance hypotheses discussed in the body of the report are collected together in Appendix A. Appendix B summarizes the performance parameters and Appendix C contains an introduction to the Software instrumentation Package(SIP). GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N79-11762 Pennsylvania State Univ., University Park.
AN ADAPTIVE FINITE-DIFFERENCE METHOD FOR SOLVING THE STURM-LIOUVILLE PROBLEM Ph.D. Thesis
David Alan Nelson 1978 190 p
Avail: Univ. Microfilms Order No. 7818779

An adaptive finite-difference method in which the final mesh of grid points depends on the solution is developed. The non-uniform discretization and the resulting matrix problem are explored by establishing all the important properties, selecting a solution method, deriving convergence results and error estimates, and examining mesh refinement criteria. An automatic technique is presented for computing an initial estimate to the solution, monitoring the solution during the iteration process to insure convergence to the correct solution, and solution of singular S-L problems. The performance of our algorithm in terms of space and time requirements versus the eigenvalue index k, to ensure that the method has practical application is evaluated. Numerical solutions are presented for several problems, both regular and singular, along with other numerical results used to substantiate the theoretical results. Dissert. Abstr.

N79-11763 Carnegie-Mellon Univ., Pittsburgh, Pa.
FORMALIZATION AND AUTOMATIC DERIVATION OF CODE GENERATORS Ph.D. Thesis
Roderic Geoffrey Galton Cattell 1978 147 p
Avail: NTIS Avail: Univ. Microfilms Order No. 7815197

Code generators, machine descriptions, and automatic construction of code generators from machine descriptions are discussed. A code generation scheme is proposed in which a parse-tree-like intermediate program representation is translated into machine code. The code generator is based on transformations of the program tree specified by machine-dependent tables: the use of this scheme in a optimizing compiler is discussed. A model of instruction set processors is proposed, on which the description of the target machine is based. The target machine description specifies the effect of each instruction on the processor state. The code generator's tables are derived from this description by a heuristic search for optimal code sequences, in which a set of axioms specifying program/tree equivalences are used to decompose program trees into sequences of target machine instructions. Dissert. Abstr.

N79-11764 Ohio State Univ., Columbus.
A FINITE DOMAIN-TESTING STRATEGY FOR COMPUTER PROGRAM TESTING Ph.D. Thesis
Edward Ira Cohen 1978 222 p
Avail: Univ. Microfilms Order No. 7819569

An effort to replace the intuitive principles on which current program testing procedures are based with a methodology firmly based on a mathematical analysis of how the testing process works and what its limitations are is presented. The domain testing strategy is described, which characterizes a set of test data which can detect many major classes of programming errors. The strategy is developed for both linear and nonlinear predicates, and both continuous and discrete input spaces are treated. A test data selection criterion is provided, which is based on a mathematical analysis of program computation and the testing process. The criterion is both elegant and simple and can lead to practical and efficient implementations. The domain testing strategy offers a major reduction in the high cost of computer program testing with only a minimal loss of testing effectiveness. Dissert. Abstr.

N79-11765 Yale Univ., New Haven, Conn.
INVERSE TRANSLATION: THE THEORY OF PRACTICAL AUTOMATIC PROGRAMMING Ph.D. Thesis
Steven Peter Reiss 1977 241 p
Avail: Univ. Microfilms Order No. 7818093

Programming is an expensive and time-consuming task that should be automated to the greatest extent possible. This extent is determined and the bounds and directions for the task of practical automatic programming are given. The problem of inverting a semantics-specifying mapping is shown. A specific problem is defined by a mapping that takes the target language into the source, and that automatic programming is just the task of inverting this mapping. Examples of how practical problems can be defined using mappings and algorithms are presented. New directions for automatic programming efforts that should prove more successful than current ones are given. Dissert. Abstr.

N79-11766 Johns Hopkins Univ., Baltimore, Md.
DIRECTLY EXECUTED LANGUAGES Ph.D. Thesis
Lee Windsor Hoevel 1978 193 p
Avail: Univ. Microfilms Order No. 7817949

Execution architectures are analyzed for systems constrained to a known user behavior, source language, and host machine. The central issue is how and when identifiers appearing in an instruction stream should be bound to semantic interpretations. Format and identification mechanisms are proposed that permit later binding and reduce the number of overhead instructions. Together, these two results lead to execution architectures (here called DELs, for directly executed languages) that are optimal in the sense that: (1) only k executable instructions are needed to represent a source statement containing k functional operators; (2) the space needed to represent the executable form of a source statement grows linearly with respect to the log of the number of distinct identifiers it contains; and (3) the number of memory accesses required to execute a statement grows linearly with respect to the sum of the number of distinct operators and operands it contains. Dissert. Abstr.

N79-11767* Office of the Comptroller (Navy), Washington, D. C.
MINIGAP GENERALIZED ANALYSIS PACKAGE: A TOOL FOR AIDING MANAGEMENT IN ANALYSIS OF LARGE DATA BASES. USER'S MANUAL
Sheryl Masiello 20 Apr. 1978 48 p
(AD-A056056; MGAP-UG-01; DOD/DF-78/003B) Avail: NTIS HC A03/MF A01 CSCL 09/2

This document provides the necessary instructions for using MINIGAP. It is aimed at Interdata-knowledgeable users. It assumes that the data has been previously loaded into a MINIGAP database. The specifications of the data files are contained in the MINIGAP PROGRAMMER'S MANUAL. This manual contains samples of outputs generated by MINIGAP. Each sample output report is accompanied with the user-defined input file used to generate the report. Author (GRA)

N79-11768# Office of the Comptroller (Navy), Washington, D. C.
MINIGAP GENERALIZED ANALYSIS PACKAGE: A TOOL FOR AIDING MANAGEMENT IN ANALYSIS OF LARGE DATA BASES. PROGRAMMER'S MANUAL
Sheryl Masiello 20 Apr. 1978 111 p
(AD-A056055; MGAP-PG-01; DOD/DF-78/003A) Avail: NTIS HC A06/MF A01 CSCL 09/2

This document is intended to help programmers understand the software of the MINIGAP report generation and generalized analysis package. It includes flow charts, descriptions of the input files, descriptions of the subroutine modules, and cross-indexing of the subroutine calls. This guide should enable a FORTRAN programmer to understand the MINIGAP system well enough to modify the system as desired. The MINIGAP USER'S MANUAL is necessary to understand how to use the system. The USER'S MANUAL and the PROGRAMMER'S MANUAL should be supplied with each MINIGAP system. Author (GRA)

N79-11769# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
PERFORMANCE EVALUATION OF HIGH-LEVEL LANGUAGE SYSTEMS Interim Report
Bruce Leverett Nov. 1977 44 p refs
(Contract F44620-73-C-0074; ARPA Order 2466)
(AD-A056068; AFOSR-78-1088TR) Avail: NTIS HC A03/MF A01 CSCL 09/2

One of the concerns of the compiler writer is the quality of object programs produced by the compiler, and in particular their performance at execution time. A survey of methods for measuring this performance, and experiments with the use of those methods, is presented. We examine two general categories of evaluation: comparative evaluation, in which benchmark programs are run on groups of language systems; and analytic evaluation, in which a single system is measured in terms determined by its own structure. Besides surveying the results of various evaluation

experiments, we present in detail the results of a series of experiments on a particular language system (PDP11 ALGOL 68-S). Author (GRA)

N79-11770# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

QUADRATURE CLOCK MODULATION VERSUS BINARY AND QUADRATURE PHASE SHIFT KEYING IN THE PRESENCE OF INTERSYMBOL INTERFERENCE M.S. Thesis

Gary A. White Dec. 1977 84 p refs
(AD-A056518; AFIT/GE/EE/77-37) Avail: NTIS HC A05/MF A01 CSCL 09/4

Quadrature Clock Modulation (QCM) is a binary phase shift keying (BPSK) technique in which alternate bits are transmitted orthogonally. Compared to normal BPSK modulation, QCM improves the performance of a communication system which is limited by intersymbol interference (ISI). Compared to quadrature phase shift keying (QPSK) for the same information rates, QCM is slightly inferior in data detection performance. The average carrier tracking capability of a QCM scheme is equal to that of BPSK for the same closed-loop bandwidth and time bandwidth product (BT) of the channel filter at a specified signal energy to noise ratio (Eb/No). The data detection performance for QCM, BPSK, and QPSK is analyzed by comparing the one-shot probability of error conditioned on a phase error as a function of Eb/No and BT for a specified channel filter. Carrier tracking performance for QCM and BPSK is analyzed by obtaining an average phase error variance for the linear model of a Costas loop. GRA

N79-11771# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

SOFTWARE STRUCTURE DESIGN TECHNIQUES APPLIED TO EMBEDDED COMPUTER SYSTEM SOFTWARE M.S. Thesis

Robert J. DeSanto Dec. 1977 104 p refs
(AD-A056517; AFIT/GE/EE/77-14) Avail: NTIS HC A06/MF A01 CSCL 01/3

Constantine's structured design methodology is applied to a real-time (flight) software program. A modified finite-state technique is successfully applied to an operational flight program (OFP) mainloop. Transform and transaction analysis are successfully applied to mainloop tasks. Each technique is demonstrated to show avionics software engineers/contract monitors 'how to get started' on a design. Two hypothetical software modifications illustrate advantages of structured design over the current software implementation. Short and long term effects of structured designed OFPs are briefly described. An OFP familiarization and design methodology is developed for avionics software engineers/contract monitors. GRA

N79-11772# Oregon State System for Higher Education, Monmouth.

ALGORITHMS FOR DEVELOPING TEST QUESTIONS FROM SENTENCES IN INSTRUCTIONAL MATERIALS Interim Report, Jan. 1977 - Sep. 1977

Gale H. Roid and Patrick Finn Jun. 1978 31 p refs Sponsored in part by DARPA
(Contract MDA903-77-C-0189)
(AD-A056614; NPRDC-TR-78-23) Avail: NTIS HC A03/MF A01 CSCL 05/10

The feasibility of generating multiple-choice test questions by transforming sentences from prose instructional materials was examined. A computer-based algorithm was used to analyze prose subject matter and to identify high-information words. Sentences containing selected words were then transformed into multiple-choice items by four writers who generated foils or question alternatives informally and by an algorithmic method. Items were organized into tests and administered to subjects before and after they had studied instructional materials. Results indicated that this item-writing technique was feasible and that algorithmic methods of generating foils produce items of reasonably good quality. Author (GRA)

N79-11773# Naval Ocean Systems Center, San Diego, Calif.

PROPOSED JTIDS SOFTWARE ACQUISITION PLAN WITH EMPHASIS ON NAVY INSTRUCTIONS/DIRECTIVES Final Report, Jan. - May 1978

J. T. Shen 5 May 1978 53 p
(AD-A056630; NOSC/TD-167) Avail: NTIS HC A04/MF A01 CSCL 05/1

Designed to provide guidance to Navy personnel involved in software acquisition and management, this document contains sections on software life-cycle and major milestones; software planning within a system acquisition; managing the software development; and verification, validation, and certification. Author (GRA)

N79-11774# Army Armament Research and Development Command, Dover, N. J. Management Information Systems Directorate.

PHASOR PHYSICAL ANALYSIS OF SOLIDS OF REVOLUTION, USER MANUAL Final Report

Bruce D. Carbrey Apr. 1978 320 p refs
(AD-A057682; MISD-UM-78-4) Avail: NTIS HC A14/MF A01 CSCL 12/1

PHASOR (PHysical Analysis of Solids of Revolution) is a large interactive graphics computer program for computing the weight, center of gravity, volume, and moments of inertia of axisymmetric bodies such as projectiles, rockets, bombs, etc. A Tektronix 4014 graphic terminal is required to run PHASOR on the CDC 6500/6600 computer. The program includes many flexible capabilities, including file generation/modification, a graphic text editor, tablet input, and output on disk, punch, plotter, CRT, and line printer. GRA

N79-11775# Applied Physics Lab., Johns Hopkins Univ., Laurel, Md.

THE ART OF SIMULATION: SOME TOOLS AND TECHNIQUES DEVELOPED AT THE APPLIED PHYSICS LABORATORY

L. R. Gieszl Mar. 1978 40 p refs
(Contract N00017-72-C-4401)
(AD-A057395; ARL/JHU/TG-1316) Avail: NTIS HC A03/MF A01 CSCL 14/2

In this paper two devices are used to narrow the communications gap between the end users of large-scale computer reliant models and the analysts who must find, review, or create such models. The first device involves the use of examples to describe the significant characteristics of three simulation techniques: event-store, ASTN, and hierarchical interrogation. The second device makes use of multiple equivalences. In this case, the conversion from one modeling technique to another (which shows the two to be equivalent) is prompted by a consideration of some salient features within the process to be simulated. The subliminal nature of these techniques and the causal implicative chains leading to their implementation is discussed from a user-oriented point of view. A section on decision tables and a decision table processor is included to assure a clear treatment of hierarchical decision table interrogation. GRA

N79-11776# Stanford Univ., Calif. Dept. of Electrical Engineering.

OPTIMAL DATA COMPRESSION ALGORITHMS Final Report, 1 May 1973 - 30 Apr. 1978. Ph.D. Thesis

Robert M. Gray and Martin E. Hellman 30 Apr. 1978 26 p refs
(Contract F44620-73-C-0065; AF Proj. 2304)
(AD-A057305; AFOSR-78-117STR) Avail: NTIS HC A03/MF A01 CSCL 09/3

This research project on optimal compression algorithms was concerned with several problems in the area of digital communications and the elimination of redundancy. The importance of the problem arises from the growing use of digital transmission in the military as well as the civilian communications field. There are many advantages enjoyed by digital transmission, the most notable being that there is almost no signal to noise degradation when relayed through a number of repeaters, whereas analog repeaters lose 3 db every time the number of repeaters is doubled. The one marked disadvantage of digital transmissions is that digitization of a basically analog source such as speech or TV results in a bandwidth expansion using conventional techniques. Good quality digitized voice requires on the order of 50,000 bits per second if data compression is not used. With conventional techniques, this requires 30 kHz of bandwidth while the analog

voice signal could be transmitted over a 3 kHz channel. The area of bandwidth compression seeks to remove this disadvantage by eliminating the redundancy in the signal. GRA

N79-11777# Rochester Univ., N. Y. Dept. of Computer Science.
FAST DISPLAY OF WELL-TESSELATED POLYHEDRA
Christopher M. Brown Mar. 1978 23 p
(Contract N00014-75-C-1091)
(AD-A057312; TR-23) Avail: NTIS HC A02/MF A01 CSCL 12/1

Well-tesselated polyhedra are a subclass of those polyhedra whose faces are triangular, possibly transparent, and all visible from a single origin point. They admit of simple hidden-line and-surface algorithms. In a raster graphics environment, the algorithms yield a priority ordering for painting entire faces. This order is invariant over radial translations of polyhedral vertices (therefore invariance extends to the perspective transformation). Specific methods for creating well-tesselated polyhedra are given, and general constraints defining them are stated. An efficient hidden surface algorithm is presented; a simpler method for the case of opaque faces also produces hidden line drawings. Demonstrations of correctness are provided. Author (GRA)

N79-11778# New York Univ., N. Y. Courant Mathematics and Computing Lab.
CONFIGURABLE SOFTWARE FOR SATELLITE GRAPHICS
P. D. Hartzman Dec. 1977 176 p refs
(Contract EY-76-C-02-3077)
(COO-3077-148) Avail: NTIS HC A09/MF A01

A distributed graphics system in which a minicomputer and a powerful large computer share the work is presented. The most versatile type of distributed system is an intelligent satellite system in which the minicomputer is programmable by the application user and can do most of the work while the large remote machine is used for difficult computations. The hardware was configured from available equipment. The level of system intelligence resulted almost completely from software development. The software was written in a systems implementation language; thus, only one set of programs was needed for both machines. Tests of the system with an application program indicate that it has very high potential. The demonstration that a gigantic investment in new hardware is not necessary for computing facilities interested in graphics is presented. DOE

N79-11779# Argonne National Lab., Ill.
STUDY OF THE MATHEMATICAL ROUTINES IN THE IBM SYSTEM/360 FORTRAN 4 AND FORTRAN 4 (MOD 2) LIBRARIES
J. Y. Wang and J. F. Boyar Jan. 1978 26 p
(Contract W-31-109-eng-38)
(ANL-AMD-TM-304) Avail: NTIS HC A03/MF A01

The differences which exist between the mathematical functions in the IBM FORTRAN IV library and the FORTRAN IV (MOD II) library are determined. The differences between the libraries were classified into nine categories. With these results, it was possible to modify some assembler routines in ANL Mathematical Subroutine Library (AMDLIB) so that they were compatible with both the FORTRAN and MOD II libraries. DOE

N79-11780# Sandia Labs., Albuquerque, N. Mex.
COLORS REFERENCE MANUAL
D. B. Saylors Apr. 1978 50 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0643) Avail: NTIS HC A03/MF A01

A package of subroutines was added to the Sandia Interactive Graphics System to display shaded surface color pictures on the Comtal 8300. The general framework of the package is described and a detailed description of each usercallable subroutine is given. DOE

N79-11781# Sandia Labs., Albuquerque, N. Mex.
GCS: THE GRAPHICS COMPATIBILITY SYSTEM
R. F. Puk 1978 19 p refs Presented at ACM Siggraph meeting, Atlanta, Ga., 21 Aug. 1978
(Contract EY-76-C-04-0789)
(SAND-78-0307C; Conf-780816-2) Avail: NTIS HC A02/MF A01

GCS is a collection of ANS FORTRAN subroutines which is widely distributed, mostly in the United States, but also to several international installations. While GCS was originally designed for static graphics applications in two dimensions, continued development has produced a powerful, general-purpose three-dimensional wire-frame graphics system for both static and dynamic applications with several unique features. The internal structure of GCS is based on research which identified graphics functions supported in the hardware of many devices. An interface is provided to most recognized display device-supported graphics functions, which allows GCS to utilize this hardware when available. If not available, either a simulator is substituted or the function is ignored. Computer-dependent operations are isolated to allow convenient implementation of GCS on various computer systems. DOE

N79-11782# Oak Ridge Gaseous Diffusion Plant, Tenn. Dept. of Computing Applications.
COLLECTION OF FORTRAN SUPPORT ROUTINES
Steven B. Cliff Jan. 1978 136 p refs
(Contract W-7405-eng-26; Grants NSF GK-37434; HL-15564)
(K/CSD/TM-20) Avail: NTIS HC A07/MF A01

Several routines designed to support and extend FORTRAN programs used on the IBM 360/370 series computers are described. These routines, which were used in a variety of programs, run the gamut from input processors to timers, to absolute address accessors, and to mathematical analysis routines. Most of the routines are written in IBM 360/370 assembler language. DOE

N79-11783# Kaman Sciences Corp., Colorado Springs, Colo.
GO METHODOLOGY: FAULT SEQUENCE IDENTIFICATION AND COMPUTER CODE MANUAL Final Report
B. B. Chu May 1978 317 p
(EPRI Proj. 818)
(EPRI-NP-767) Avail: NTIS HC A14/MF A01

The GO methodology is a computerized system reliability analysis technique. The methodology consists of two parts, system reliability evaluation and system fault sequence identification. The method employs a straightforward inductive logic for constructing system models; all possible system response modes, both successes and failures, are then determined. Documentation of the Fault Finder programs SYSFILE, FF1, and FF2 is provided. DOE

N79-11784# Sandia Labs., Albuquerque, N. Mex.
USER/PROGRAMMER GUIDE FOR UCMD56: POSITIVE NATURAL/AGS UNITS SETTING
N. J. Nelson Nov. 1977 11 p refs
(Contract EY-76-C-04-0789)
(SAND-77-1440) Avail: NTIS HC A02/MF A01

The program UCMD56, an applicon AGS/870 user command to set the positive condition to natural units or AGS units depending on the argument entered is described. DOE

N79-11785# Battelle Pacific Northwest Labs., Richland, Wash.
COMP: A BASIC LANGUAGE NONLINEAR LEAST SQUARES CURVE FITTING PROGRAM
J. M. Thomas, M. I. Cochran, C. R. Watson, and L. L. Eberhardt Nov. 1977 54 p refs
(Contract EY-76-C-06-1830)
(PNL-2409) Avail: NTIS HC A04/MF A01

COMP is used to obtain estimates of parameters in nonlinear functions and to approximate their associated statistical errors. The linearizing (or Taylor Series) expansion of partial derivatives is used. Partial derivatives are supplied by the user for any new models not currently contained in the programs. When a linearizing method is used to estimate parameters in a nonlinear model, all the usual procedures of linear regression theory can be applied. The results obtained are only valid insofar as the linearized form approximates the true model. All of the statistics computed by COMP are viewed with this restriction in mind. The output of COMP includes the variance-covariance matrix, t-tests for parameters, Von Neumann's ratio observed, predicted and residual values, the error mean square, and an/optional procedure to evaluate heteroscedasticity. DOE

N79-11786# Bari Univ. (Italy). Ist. di Costruzioni di Macchine.
CAPABILITIES OF DYNAMIC ANALYSIS OF A NEW RELEASE OF STRUDL: IL DELFT [CAPACITA DI ANALISI DINAMICA DI UNA NUOVA VERSIONE DELLO STRUDL: IL DELFT]
Bruno Atzori and Franco Fresa Dec. 1976 20 p refs In ITALIAN; ENGLISH summary
(IIW-6-76) Avail: NTIS HC A02/MF A01

The capabilities of dynamic analysis of a new release of STRUDL, edited by the Delft University of Technology, are analyzed. Only the case of frame analysis was examined. Results are compared with those previously obtained using the original STRUDL 2 version. Author (ESA)

N79-11787# Mathematics and Computation Lab., Washington, D. C. Time-sharing Systems Div.
SDF INPUT-OUTPUT ROUTINES FOR FORTRAN 5 Final Report
William H. Morrison May 1978 14 p
(PB-283455/4; GSA/FPA/MCL-PMR-26-REV-2) Avail: NTIS HC A02/MF A01 CSCL 09B

The SDF I/O routines for FORTRAN 5 provided a capability to the FORTRAN programmer to create and retreive data images as ASCII or Fieldata in print file or program file formats. This document was designed to familiarize the FORTRAN 5 programmer with callable subroutines, available on the Federal Preparedness agency Univac 1100 operating system, which allowed the creation and retrieval of data elements. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N79-11788 Ohio State Univ., Columbus.
PERFORMANCE ANALYSIS OF THE DISTRIBUTED LOOP COMPUTER NETWORK Ph.D. Thesis
Gojko A. Babic 1978 251 p
Avail: Univ. Microfilms Order No. 7819560

The Distributed Loop Computer Network (the DLCN system) is envisioned as a powerful, unified distributed computing system which interconnects midi/mini/micro-computers, terminals and other peripherals through careful integration of hardware, software and a loop communication network. The performance analysis of the DLCN system is discussed. Queueing theoretic tools and analytical models to predict the overall performance of the DLCN system are used. The analysis of the traffic behavior and development of queueing model are presented for the DLCN communication network (the communication part of the DLCN system). The performance of the DLCN communication network and its transmission mechanism over those of the other two distributed-control loop communication networks, the Newhall loop and the Pierce loop are verified. A new approach to analyzing loop computer networks is developed. Dissert. Abstr.

N79-11789# Commerce Dept., Boulder, Colo. Inst. for Telecommunication Sciences.
ARPANET HOST TO HOST ACCESS AND DISENGAGEMENT MEASUREMENTS
Judd A. Payne May 1978 62 p refs
(PB-283554/4; NTIA/REPORT-78/3) Avail: NTIS HC A04/MF A01 CSCL 17B

A set of telecommunications performance parameters were developed for proposed Federal standard 1033. The measurement of five of these parameters, access time, incorrect access time, access denial probability, disengagement time, and disengagement failure probability were considered. The telnet protocol of the ARPANET was employed to measure the access and disengagement parameters from a Host to Host connection. GRA

N79-11790# Office of Management and Budget, Washington, D. C.
FEDERAL DATA PROCESSING REORGANIZATION STUDY: STANDARDS TEAM REPORT Final Report
Paul Oliver and Robert Blanc 12 Jun. 1978 79 p refs
(PB-283756/5) Avail: NTIS HC A05/MF A01 CSCL 09B

The Federal data processing reorganization project was initiated to study recommended improvements in the way in which the Federal Government acquires, manages and uses technology. Five teams studied the management of information technology by executive departments and agencies and five teams studied information technology management issues which cut across agency lines. The standards team was tasked to study the Federal information processing standards program, the purpose of which was to further economic and operational advantages through the standardization of automatic data processing hardware, software and systems. GRA

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N79-11791 Columbia Univ., New York.
ADAPTIVE ROUTING IN COMPUTER COMMUNICATION NETWORKS Ph.D. Thesis
Tak Shing Peter Yum 1978 264 p
Avail: Univ. Microfilms Order No. 7819469

A comparative analysis is presented of adaptive routing rules for distributed computer communication networks. The rules studied are classified according to the type and amount of information they use. Thus, going from the simplest to the most complex there are rules that use only information available at a particular node; local plus fixed rules that incorporate some network control information as well; local plus fixed plus feedback rules that incorporate information as to traffic at neighboring nodes; and local plus fixed plus varying plus feedback rules. It is found that the embedding of an adaptive component on a fixed rule base gives improvement of 10-27% over the fixed rule, depending on network utilization and the amount of asymmetry in the traffic matrix. As the utilization is reduced, decreasing the time delay, the relative improvement due to adaptation is reduced. Dissert. Abstr.

N79-11792# Illinois Univ. at Urbana-Champaign, Savoy. Decision and Control Lab.
DECENTRALIZED STACKELBERG STRATEGIES FOR INTERCONNECTED STOCHASTIC DYNAMIC SYSTEMS
Sulvalai Pratishthananda Glankwamdee Oct. 1977 106 p refs Sponsored in part by NSF
(Contract DAAB07-72-C-0259; EX-76-C-01-2088; Grant NSF ENG-74-20091)
(AD-A057648; DC-14) Avail: NTIS HC A06/MF A01 CSCL 12/1

A two level sequential decision formulation for the control of interconnected stochastic linear discrete-time systems is investigated. An interconnection of several systems is considered, whereby each subsystem has a decision maker and an associated quadratic cost function. One of the decision makers is designated as a leader or coordinator and his control strategies are to be chosen prior to those of the others. The information available to each decision maker may be different from those of the others. The second level decision makers are regarded as followers in the context of Stackelberg strategies. Their strategies are in accordance with the Nash equilibrium concept or Pareto optimal concept except that the coordinator's strategy is known to all of them. The coordinator chooses his strategy under the assumption that the followers will fully exploit the prior announcement of his strategy. Centralized and decentralized information are considered. Dynamic programming is employed to derive the recursive equations for determining the control laws for each subsystem. Decentralized information structure is more attractive since each subsystem control law is based only on local measurements. However, a two-point boundary value problem has to be solved. A simple algorithm is suggested but conditions for convergence are not yet available. Finally, a decentralized Stackelberg strategies for an interconnected power system is suggested. The design procedure emphasizes proportional plus integral control in the context of Stackelberg strategies. Author (GRA)

N79-11793# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
MECHANICAL THEOREM PROVING AND ARTIFICIAL INTELLIGENCE LANGUAGES Ph.D. Thesis
Mark E. Stickel 6 Dec. 1977 355 p refs
(Contract F44620-73-C-0074; Grant NSF GJ-28457; ARPA Order 2466)
(AD-A056071; AFOSR-78-1091TR) Avail: NTIS HC A16/MF A01 CSCL 09/2

This dissertation is principally concerned with incompleteness issues in the design of artificial intelligence languages. Major sources of incompleteness are the pattern matching and inference facilities of the languages. Incompleteness in the area of pattern matching can be repaired by developing unification algorithms for the specialized data types of the languages. A complete, but potentially infinite unification process is described for arbitrary data types in general and is applied to the QA4/QLISP vector, bag, and class data types. Finite, complete unification algorithms are also described for the bag and class data types. The bag unification algorithm is extended to the case of unification of first order predicate calculus terms with functions which are both associative and commutative. Incompleteness in the area of the inference system can be repaired by use of some form of the pi inference procedure which is a complete extension derived from model elimination of the problem reduction method. This can readily be accomplished in present or new artificial intelligence languages by attempting to derive all goals in the context of the asserted negations of all higher goals. GRA

N79-11794# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
SYSTEM ENGINEERING TECHNIQUES FOR ARTIFICIAL INTELLIGENCE SYSTEMS Interim Report
Lee D. Erman and Victor R. Lesser (Massachusetts Univ., Amherst) Dec. 1977 24 p refs
(Contract F44620-73-C-0074; ARPA Order 2466)
(AD-A056067; AFOSR-78-1087TR) Avail: NTIS HC A02/MF A01 CSCL 06/4

It is impossible to develop a large knowledge-based artificial intelligence system successfully without careful attention to issues of system engineering. A set of principles is presented for organizing the design and implementation of such a system. Problems of maintainability and configuration control, human engineering, performance analysis, and efficiency must be faced. Tools used to solve these problems are described, along with examples of their use in the Hearsay-II speech understanding system. Author (GRA)

N79-11795# Delaware Univ., Newark. Dept of Statistics and Computer Science.
A VERSATILE MARKOVIAN POINT PROCESS Interim Report
Marcel F. Neuts Oct. 1977 29 p refs
(Grant AF-AFOSR-3236-77; AF Proj. 2304)
(AD-A056051; TR-77/13; AFOSR-78-107TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

A versatile class is introduced of point processes on the real line, which are closely related to finite-state Markov processes. Many relevant probability distributions, moment and correlation formulas are given in forms which are computationally tractable. Several point processes, such as renewal processes of phase type, Markov-modulated Poisson processes and certain semi-Markov point processes appear as particular cases. The treatment of a substantial number of existing probability models can be generalized in a systematic manner to arrival processes of the type discussed in this paper. Several qualitative features of point processes, such as certain types of fluctuations, grouping, interruptions and the inhibition of arrivals by bunch inputs can be modelled in a way which remains computationally tractable. GRA

N79-11796# Delaware Univ., Newark. Dept. of Statistics and Computer Science.
FURTHER RESULTS ON THE M/M/1 QUEUE WITH RANDOMLY VARYING RATES Interim Report
Marcel F. Neuts 1978 23 p
(Contract AF-AFOSR-3236-77)
(AD-A056025; TR-78/4; AFOSR-78-1070TR) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper demonstrates that the M/M/c queue, with arrival and service rates which vary according to the state of a Markov process, has a steady-state probability vector of a modified matrix-geometric form. The rate matrix R is the unique positive solution to a quadratic matrix equation, which may be solved numerically by successive substitutions. A theorem which provides an accuracy check on that computation is proved. Finally a numerical example is discussed and its results are interpreted. GRA

N79-11797# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
AUTOMATIC RECOGNITION OF SYNTHETIC SPEECH USING AN ELECTRONIC MODEL OF THE MIDDLE AND INNER EAR Ph.D. Thesis
Donald B. Warmuth 5 Jun. 1978 168 p refs
(AD-A056509; AFIT/DS/EE/78-3) Avail: NTIS HC A08/MF A01 CSCL 06/4

A phoneme-based automatic speech recognition system was developed and tested using synthetic speech. The acoustic signal is divided into short segments for analysis; segments are either a single pitch period of voiced speech or a 10 ms sample of voiceless speech. These segments are independently analyzed and given a phonemic name by three different measures. The sub-phonemic segments are grouped using measures which reflect dynamic changes in the speech signal. Each group of segments represents a phoneme and is identified by simple algorithms operating on the string of phonemically-named segments that form the group. The phoneme-based recognition system was tested using isolated synthesized words which permitted evaluation with connected strings of phonemes but stopped short of requiring development of word boundary rules. The tests consisted of 100 phonemically balanced words containing 281 phonemes. Of these, 245 were correctly identified, 23 were mis-identified, 13 were missed entirely, and 11 were added. However, many of these errors were predictable or understandable and may be overcome at a higher (word or phrase) level. Author (GRA)

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N79-11798 California Inst. of Tech., Pasadena.
TOPICS IN BIFURCATION THEORY. 1: EXISTENCE AND STRUCTURE OF BIFURCATION BRANCHES. 2: CONSTRUCTIVE TECHNIQUES FOR THE GENERATION OF SOLUTION BRANCHES Ph.D. Thesis
Dwight William Decker 1978 156 p
Avail: Univ. Microfilms Order No. 7815978

The problem of bifurcation is formulated as an operator equation in a Banach space, depending on relevant control parameters. A method is described in which the dependence of the solution arc on a naturally occurring parameter is replaced by the dependence on a form of pseudo-arclength. In the neighborhood of bifurcation points, the associated linear operator is nearly singular causing difficulty in the convergence of continuation methods. The approach to singularity of this operator is studied. Results yields convergence proofs for an iterative method for determining the solution arc in the neighborhood of a simple bifurcation point. Dissert. Abstr.

N79-11799 Ohio State Univ., Columbus.
REDUCIBLE PARTITIONS OF PERMUTATION GROUPS AND THE RECONSTRUCTION OF GRAPHS FROM PENDANT VERTEX DELETED SUBGRAPHS Ph.D. Thesis
Steven Edward Anacker 1978 192 p
Avail: Univ. Microfilms Order No. 7819555

The vertex reconstructibility of a general graph G is considered. Connected separable graphs containing a pendant vertex and a cycle have a decomposition called a pruning consisting of a trunk and disjoint trees each having a single vertex in common with the trunk. If a graph has a pruning, then its vertex

reconstructibility can sometimes be determined by studying which graphs have a vertex x whose unique neighbor is fixed under A(G - x). Using the theory of permutation groups, many results are shown among which is the result that if a graph has an s-regular trunk of degree p+1, p a prime, and if the number of vertices in any tree exceeds p+2 then G has a fixed pendant vertex. Using techniques similar to those used to study the *-fixed pendant vertex problem, a theory of reconstructing graphs from their pendant vertex deleted subgraphs is developed.
Dissert. Abstr.

N79-11800 Delaware Univ., Newark.
LOW FREQUENCY ITERATIVE SOLUTION OF INTEGRAL EQUATIONS IN ELECTROMAGNETIC SCATTERING THEORY Ph.D. Thesis
George Amelung Gray 1978 199 p
Avail: Univ. Microfilms Order No. 7818570

The scattering of electromagnetic waves by a perfectly conducting object is investigated. The incident field is assumed to be time harmonic and the scatterer a closed bounded Lyapunov surface with no holes. A boundary integral equation for the total field (incident plus scattered) is derived using an integral representation of the total field analogous to Green's formula. The proof that this boundary integral equation can be solved by iteration rests on showing that the spectral radius of the resulting integral operator is less than one for small perturbations of the corresponding potential operator. Dissert Abstr.

N79-11801 Princeton Univ., N. J.
BOUNDARY BEHAVIOR OF HOLOMORPHIC FUNCTIONS ON WEAKLY PSEUDOCONVEX DOMAINS Ph.D. Thesis
David William Catlin 1978 93 p
Avail: Univ. Microfilms Order No. 7818315

For a class of smoothly bounded complex manifolds which includes the pseudoconvex domains in C to the n power with smooth boundary, the author studies the boundary behavior of A to infinity (Omega), where A to infinity (Omega) denotes the space of holomorphic functions on the manifold Omega that are smooth up to the boundary. The holomorphic convexity properties of A to infinity (Omega) at the boundary are examined, with special attention given to the case when the dimension of Omega is two. An approximation on compact subsets of the closure of Omega is also proved. Finally, by means of the technique used to prove the approximation theorem, it is shown that there exists a function f, an element of A to infinity (Omega), which cannot be extended analytically to a neighborhood of any boundary point. Dissert. Abstr.

N79-11802 Yale Univ., New Haven, Conn.
FINITE ELEMENT METHODS FOR SINGULAR TWO-POINT BOUNDARY VALUE PROBLEMS Ph.D. Thesis
Robert Samuel Schreiber 1977 152 p
Avail: Univ. Microfilms Order No. 7818097

The idea of approximating the solution with piecewise polynomials on a nonuniform mesh adapted on the singularity is investigated. Given knowledge of the singularity, it is possible to construct a sequence of graded meshes such that the rate of convergence in the L superscript 2 norm is the best possible. Upper and lower bounds are proven on the extent to which the mesh must be graded. Error bounds and numerical results are obtained for these weighted splines which indicate that they are the best for practical computation. For a third subspace known error bounds are improved by using a mildly graded mesh. Previous results are upgraded by removing any restriction on n, by adding the requirement that the approximating spline functions be smooth at the center of the n-dimensional domain, and by obtaining error bounds (of the best possible order) in the natural norms for the problem. Dissert. Abstr.

N79-11803 Princeton Univ., N. J.
SOLUTION OF STIFF ORDINARY DIFFERENTIAL EQUATIONS BY DECOMPOSITION AND ORTHOGONAL COLLOCATION Ph.D. Thesis
Maria Karpati Burka 1978 164 p
Avail: Univ. Microfilms Order No. 7818317

A method was developed which uses ordering, decoupling, and tearing techniques to subdivide the system into blocks of minimal size and then solves the resultant subsystems by orthogonal collocation on finite elements. This procedure is ideal for sparse systems because it allows separate solution of subsystems containing stiff variables and it is therefore not necessary to treat the whole system as a stiff problem. The various aspects of the method were tested on four examples. The decomposition procedure consists of: selection of an output variable for each equation in the system, ordering the whole set of equations (putting them in the sequence in which they have to be solved), partitioning the equations into the single equations plus the smallest cycles obtainable without tearing, and finally tearing some of these cycles by removing variable (or variables) in a systematic manner to yield even smaller blocks and/or single equations. Dissert Abstr.

N79-11804*# National Aeronautics and Space Administration, Washington, D. C.
NUMERICAL METHOD FOR SOLUTION OF SYSTEMS OF NON-STATIONARY SPATIALLY ONE-DIMENSIONAL NONLINEAR DIFFERENTIAL EQUATIONS
S. K. Morozov and O. P. Krasitskiy Nov. 1978 35 p refs Transl. into ENGLISH of "Chislenyy Metod Resheniya Sistem Nestatisionarnykh Prostranstvenno-Odnomernykh Nelineynykh Differentsialnykh Uraveniy", Rept. PR-396 Acad. of Sci. USSR, Inst. of Space Res., Moscow, 1978 p 1-37 Transl. by Sci Transl. Serv., Santa Barbara, Calif.
(Contract NASw-3198)
(NASA-TM-75557; PR-396) Avail: NTIS HC A03/MF A01 CSCL 12A

A computational scheme and a standard program is proposed for solving systems of nonstationary spatially one-dimensional nonlinear differential equations using Newton's method. The proposed scheme is universal in its applicability and its reduces to a minimum the work of programming. The program is written in the FORTRAN language and can be used without change on electronic computers of type YeS and BESM-6. The standard program described permits the identification of nonstationary (or stationary) solutions to systems of spatially one-dimensional nonlinear (or linear) partial differential equations. The proposed method may be used to solve a series of geophysical problems which take chemical reactions, diffusion, and heat conductivity into account, to evaluate nonstationary thermal fields in two-dimensional structures when in one of the geometrical directions it can take a small number of discrete levels, and to solve problems in nonstationary gas dynamics. L.S.

N79-11805# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
MINIMAX ONE LOCATION PROBLEM IN EUCLIDEAN DISTANCES WITH AN ALGORITHM [PROBLEMA MINIMAX DE UMA-LOCALIZACAO COM DISTANKIAS EUCLIDIANAS-UM ALGORITMO]
Marcos J. A. P. Pacca Aug. 1978 35 p refs in PORTUGUESE; ENGLISH summary
(INPE-1341-PE/161) Avail: NTIS HC A03/MF A01

A new Algorithm (Algorithm 1) to solve the Minimax one-location problem is E with Euclidean distances and arbitrary positive weights associated with the given points is proposed. The main theoretical background needed in the development of the algorithm is given. Another algorithm (Algorithm 2) to solve a certain type of convex subproblem in a Step of Algorithm 1 is derived and its use is discussed. Author

N79-11806# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
THE USE OF A DECOMPOSITION ALGORITHM FOR ESTIMATING THE RESULTS OF AN INPUT-OUTPUT MATRICES [USO DE ALGORITMOS DE DECOMPOSICAO NA ESTIMATI VA DE MATRIZES DO TIPO INSUMO-PRODUTO]
Mohamad Ali El-Noweichi and Marcos J. A. P. Pacca Sep. 1978 30 p refs In PORTUGUESE; ENGLISH summary Presented at Simposio Brasileiro de Pesouisa Operacional, Brasilia, 18-20 Oct. 1978
(INPE-1361-PE/169) Avail: NTIS HC A03/MF A01

The problem of updating the Input-Output matrix is formulated as a minimization problem using rectilinear norm. To solve such a large scale problem, the Dantzig-Wolfe decomposition technique is applied. The types of subproblems are presented, and the

master program is developed for such a problem. The subproblems are simple and solved by inspection. The problem is also solved using the Generalized Upper Bounding (GUB) method. A numerical example is solved and a comparison between the results is obtained by the direct application of simplex method and the other two techniques are given. S.E.S.

N79-11807# New York Univ., N. Y. Inst. of Mathematical Sciences.
BOUNDARY CONDITIONS FOR TIME DEPENDENT PROBLEMS WITH AN ARTIFICIAL BOUNDARY Interim Report
Bertil Gustafsson and Heintz-Otto Kreiss Sep. 1977 29 p refs
(Contract F44620-74-C-0062; AF Proj. 2304)
(AD-A056028; AFOSR-78-0326TR) Avail: NTIS HC A03/MF A01 CSCL 12/1

Many physical problems require the solution of partial differential equations on some infinite domain Omega with boundary del Omega. For computational reasons Omega is replaced by a finite domain Omega sub 1. The problem arises to specify boundary conditions at the artificial boundary B sub 2 and this paper discusses special techniques. GRA

N79-11808# Naval Postgraduate School, Monterey, Calif.
REGENERATIVE SIMULATION WITH INTERNAL CONTROLS
Donald L. Iglehart and Peter A. W. Lewis Jan. 1978 33 p refs
(AD-A056268; NPS-55-78-5) Avail: NTIS HC A03/MF A01 CSCL 12/1

A new variance reduction technique is introduced called internal control variables, to be used in the context of regeneration simulations. The idea is to identify a sequence of control random variables, each one defined within a regenerative cycle, whose mean can be calculated analytically. These controls should be highly correlated with the usual quantities observed in a regenerative simulation. This correlation reduces the variance of the estimate for the parameter of interest. Numerical examples are included for the waiting time process of an M/M/1 queue and for several Markov chains. Author (GRA)

N79-11809# Arizona Univ., Tucson.
SINGULAR PERTURBATIONS AND SLOW-MODE APPROXIMATIONS FOR LARGE SCALE LINEAR SYSTEMS
R. E. Malley, Jr. and L. R. Anderson Jun. 1978 9 p refs
(Contract N00014-76-C-0326; NR Proj. 041-466)
(AD-A056504; TR-22) Avail: NTIS HC A02/MF A01 CSCL 12/1

The solutions of large linear systems with slow and fast modes are well approximated away from endpoints by a slow-mode solution. This corresponds to the use of outer solutions as approximate solutions of singular perturbation problems away from boundary layer regions. This paper gives an algorithm for obtaining the slow-mode solutions, and illustrates how the slow and fast components are obtained for the initial value problem. Author (GRA)

N79-11810# Wisconsin Univ. - Madison. Dept. of Statistics.
INTERPOLATING SURFACES: HIGH ORDER CONVERGENCE RATES AND THEIR ASSOCIATED DESIGNS, WITH APPLICATION TO X-RAY IMAGE RECONSTRUCTION
Grace Wahba May 1978 32 p refs
(Contract N00014-77-C-0675)
(AD-A056171; UWIS-DS-78-523) Avail: NTIS HC A03/MF A01 CSCL 12/1

Consider the problem of interpolating a function on the unit square from values of the function given on a set (called the design) of N discrete points. Then some new results are obtained on better ways to distribute these N points so as to minimize the maximum interpolation error. GRA

N79-11811# Sperry Univac, St. Paul, Minn. Defense Systems Div.
COMPLEXITY REDUCTION IN GALOIS LOGIC DESIGN Final Report, Feb. - Dec. 1977
J. M. Marver Dec. 1977 43 p refs
(Contract N00014-77-C-0192)
(AD-A056190; PX-12461) Avail: NTIS HC A03/MF A01 CSCL 12/1

Two methods of reducing the complexity of the hardware used in Galois logic design are presented: reduced trees of Galois linear modules, and subfield multipliers. The first method lowers the number of modules in a full tree of Galois linear modules and the second method enables multiplication in a Galois field to be done with subfield multipliers. Author (GRA)

N79-11812# Florida Univ., Gainesville. Dept. of Industrial and Systems Engineering.
THE AUTOCOVARIANCE FUNCTION DETERMINED VIA THE Z-TRANSFORM, WITH APPLICATION TO BOX JENKINS FORECASTING MODELS
Eginhard J. Muth May 1978 41 p refs Supersedes RR-76-20
(Grant DAHC04-75-G-0150)
(AD-A056214; ARO-12640.28-M; RR-78-5; RR-76-20) Avail: NTIS HC A03/MF A01 CSCL 12/1

A method is presented which yields the autocovariance function of a stationary discrete-time stochastic process in closed form. Special reference is made to the Box Jenkins forecasting methodology in which the underlying process is generated by passing white noise through a linear filter. The impulse response of the filter and its Z-transform, the transfer function, are obtained from the equation which defines the filter. The bilateral Z-transform of the autocovariance function is then derived from the transfer function, and is inverted following a partially fraction expansion. Several examples of this procedure are worked out in detail, and a summary of solutions for a number of cases is given. Author (GRA)

N79-11813# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Ballistics Research Lab.
THE EVALUATION, MANIPULATION AND IDENTIFICATION OF NONDIMENSIONAL NUMBERS
Morton A. Hirschberg Jun. 1978 46 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A057694; AD-E430072) Avail: NTIS HC A03/MF A01 CSCL 12/1

This report describes a computer program which evaluates, manipulates and identifies nondimensional numbers (Pi terms, dimensionless numbers or factors) generated using the Buckingham Pi Theorem. Computations are performed using SYMBOLANG, an algebraic (symbol) manipulation package (solutions are kept in symbolic form). Manipulation occurs in two ways. First, many allowable combinations of pi terms (up to 720) are generated by changing the ordering of the dimensional equations which are solved. Second, a small group of operators (squaring, square-rooting, cube-rooting, reciprocating, and division by both the minimum and maximum exponent) are applied to each solution (these too are solutions and also kept in symbolic form). Numerical substitution into the symbolic forms produce scalars (evaluated solutions) for subsequent use (plotting, regression, factor analysis, etc.). Finally, every symbolic solution is compared with well-known nondimensional numbers (e.g., Reynold's, Weber's, etc.). If a match is found, this information is displayed. Author (GRA)

N79-11814# Stanford Univ., Calif. Systems Optimization Lab.
A LOCALLY QUADRATICALLY CONVERGENT ALGORITHM FOR COMPUTING STATIONARY POINTS
B. Curtis Eaves May 1978 31 p refs
(Contract EY-76-S-03-0326; Grants DAAG29-78-G-0026; NSF MCS-77-05623)
(AD-A057398; SOL-78-13; ARO-1524.2-M) Avail: NTIS HC A03/MF A01 CSCL 12/1

Stationary points for a system with a convex polyhedral set and a continuously differentiable function with positive definite derivatives are computed by iteratively solving the linearized problem. The procedure is shown to be a mixing of a finite number of Newton methods and to have a local convergence rate which is quadratic. The stationary point problem is of the type arising from the PIES energy model. Author (GRA)

N79-11815# Kentucky Univ., Lexington. Dept. of Engineering Mechanics.

THE BOUNDARY INTEGRAL EQUATION METHOD FOR THE NUMERICAL SOLUTION OF BOUNDARY VALUE PROBLEMS GOVERNED BY SECOND ORDER ELLIPTIC EQUATIONS
Michael L. Schulock Apr. 1978 109 p refs
(Grant AF-AFOSR-2824-75)
(AD-A057304; AFOSR-78-1184TR) Avail: NTIS HC A07/MF A01 CSCL 12/1

A new, general, boundary-integral-equation procedure for the numerical solution of boundary value problems governed by second order elliptic equations is implemented. Boundary geometry and dependent variables are approximated by means of quadratic shape functions. The procedure is applied to plane problems of anisotropic heat conduction and anisotropic elasticity. Comparisons between exact and numerical solutions are given. Author (GRA)

N79-11816# Arizona Univ., Tucson. Dept. of Aerospace and Mechanical Engineering.
DECOUPLING OF TWO-TIME-SCALE LINEAR SYSTEMS
Leonard R. Anderson Aug. 1978 12 p refs
(Contract N00014-76-C-0326)
(AD-A057307) Avail: NTIS HC A02/MF A01 CSCL 12/1

Recent studies of two-time-scale linear systems have used a simple transformation of variables to block-diagonalize the system so that fast and slow modes are decoupled. A matrix used in this transformation satisfied an algebraic Riccati equation. In this study it is shown that this transformation is unique and its eigenstructure is described. Also, a new method of computing the decoupling transformation is presented and demonstrated using the 16th-order linear model of a turbofan engine.
Author (GRA)

N79-11817# Argonne National Lab., Ill.
FINITE-ELEMENT METHOD FOR ELLIPTIC-TYPE DIFFERENTIAL EQUATIONS
C. I. Yang May 1978 21 p
(Contract W-31-109-eng-38)
(ANL-CT-78-29) Avail: NTIS HC A02/MF A01

Several physical problems which can be described by elliptic differential boundary-value problems are presented. A finite-element solution for such problems is outlined. The mathematical background of converting the differential form into an integral form is discussed. For simplicity, the trial function employed to illustrate the discretizing process and the error source is limited to a linear one. The solvability of such a discretized system is reviewed. DOE

N79-11818# California Univ., Livermore. Lawrence Livermore Lab.
DYNA2D: AN EXPLICIT FINITE ELEMENT AND FINITE DIFFERENCE CODE FOR AXISYMMETRIC AND PLANE STRAIN CALCULATIONS (USER'S GUIDE)
J. O. Hallquist 20 Mar. 1978 64 p refs
(Contract W-7405-eng-48)
(UCRL-52429) Avail: NTIS HC A04/MF A01

DYNA2D is an explicit two-dimensional plane strain and axisymmetric Lagrangian finite element and finite difference code. Spatial discretization may be accomplished by constant-stress elements that can be degenerated to triangular zones, constant-pressure variable-node elements, nine-node Lagrange elements, or finite difference zones based on the HEMP difference equations. A general slide-line capability is implemented that admits frictional sliding along arbitrary, intersecting frid lines. Gravity effects are accounted for in the initialization whenever needed, as in soil-structure interaction problems. Loading functions admit pressure and shear loadings along a boundary, body force loadings due to spinning and base accelerations, ahp nodal velocity-time histories. DOE

N79-11819# Sandia Labs., Albuquerque, N. Mex.
RENORMALIZATION METHODS FOR SEVERAL MARCHING ALGORITHMS USED IN THE DIRECT SOLUTION OF ELLIPTIC EQUATIONS
A. J. Russo Apr. 1978 30 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0736) Avail: NTIS HC A03/MF A01

The use of marching methods for the solution of elliptic partial differential equations is generally limited by an inherent instability. This limitation can, to a great extent, be overcome by renormalization procedures appropriate to the particular marching method. Two such methods and suitable renormalizations for them are described. Sample computer codes are included to illustrate the implementation of the renormalized algorithms. DOE

N79-11820# Sandia Labs., Albuquerque, N. Mex.
THEORY AND PRACTICE OF SOLVING ORDINARY DIFFERENTIAL EQUATIONS (ODE5)
L. F. Shampine Apr. 1978 89 p
(Contract EY-76-C-04-0789)
(SAND-78-0100) Avail: NTIS HC A05/MF A01

Between January 23 and 27, 1978, several lectures were presented at the Instituto de Investigaciones en Matematicas Aplicadas y en Sistemas, National University of Mexico, Mexico City. The Runge-Kutta method of solving differential equations was discussed, because its details are simple and it is illustrative of classical perturbation and asymptotic methods. DOE

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N79-11821 Rochester Univ., N. Y.
PRESERVATION OF CONE CHARACTERIZING PROPERTIES IN MARKOV CHAINS Ph.D. Thesis
Adrianus J. M. Kester 1978 164 p
Avail: Univ. Microfilms Order No. 7818266

Finite Markov chains and regularity properties similar to stochastic monotonicity are discussed. For finite state space Markov chains in discrete or continuous time, stochastic monotonicity is a property of the one-step transition matrix (the Q-matrix for continuous time chains), that can be described by stating that matrix considered as a pre-multiplying operator maps the cone of monotone vectors into itself. The concept of stochastic monotonicity is generalized from this point of view and properties are studied of Markov chains whose one-step transition matrix maps some given cone into itself.
Dissert. Abstr.

N79-11822# Stanford Univ., Calif. Dept. of Statistics.
TESTING FOR PERIODICITY IN A TIME SERIES
Andrew F. Siegel 5 Jun. 1978 35 p refs Prepared in cooperation with Wisconsin Univ., Madison
(Contract N00014-76-C-0475; Grant DAAG29-77-G-0031)
(AD-A057350; SU-TR-19) Avail: NTIS HC A03/MF A01 CSCL 12/1

In 1929, Sir R. A. Fisher proposed a test for periodicity in a time series based on the maximum spectrogram ordinate. In this paper, a one-parameter family of tests is proposed that contains Fisher's test as a special case. It is shown how to select from this family a test that will have substantially larger power than Fisher's test against many alternatives, yet will lose only negligible power against alternatives for which Fisher's test is known to be optimal. Critical values are calculated and tables using a duality with the problem of covering a circle with random arcs. The power is studied using Monte Carlo techniques. The method is applied to the study of the magnitude of a variable star, showing that these power gains can be realized in practice. GRA

N79-11823# Rice Univ., Houston, Tex. Dept. of Electrical Engineering.
AN ADAPTIVE ORTHOGONAL-SERIES ESTIMATOR FOR PROBABILITY DENSITY FUNCTIONS
G. Leigh Anderson and Rui J. P. DeFigueiredo Feb. 1978 63 p refs
(Grants AF-AFOSR-2777-75; NSF ENG-74-17955)
(AD-A056065; EE-TR-7803; AFOSR-78-1083TR) Avail: NTIS HC A04/MF A01 CSCL 12/1

Given a sample set X1,...,XN of independent identically distributed real-valued random variables, each with the unknown probability density function f(.), the problem considered is to estimate f from the sample set. The function f is assumed to

be in L2(a,b); f is not assumed to be in any parametric family. This paper constructs an adaptive two-pass solution to the problem: in a pre-processing step (the first pass), a preliminary rough estimate of f is obtained by means of a standard orthogonal-series estimator. In the second pass, the preliminary estimate is used to transform the orthogonal series. The new, transformed orthogonal series is then used to obtain the final estimate. The paper establishes consistency of the estimator and derives asymptotic (large sample set) estimates of the bias and variance. It is shown that the adaptive estimator offers reduced bias (better resolution) in comparison to the conventional orthogonal series estimator. Computer simulations are presented which demonstrate the small sample set behavior. A case study of a bimodal density confirms the theoretical conclusions.
Author (GRA)

N79-11824# Iowa Univ., Iowa City.
A NOTE ON BAYESIAN SIMULTANEOUS LINEAR REGRESSION WITH CONSTANT SLOPES Progress Report, Oct. 1977 - May 1978
Charles Lewis (Ill. Univ. at Urbana-Champaign) and Melvin R. Novick 1 Jun. 1978 20 p refs
(Contract N00014-77-C-0428; rr0420401)
(AD-A057697; TR-78-1) Avail: NTIS HC A02/MF A01 CSCL 12/1

This paper refines and extends the work on simultaneous estimation of regressions in m groups. The posterior model estimation equations are restated in terms of sufficient statistics thus reducing the amount of computation required at each iteration and the amount of computer storage required. New estimates from marginal modes are also provided. The work is also extended to the two-way layout. GRA

N79-11825# Iowa Univ., Iowa City.
A FAST SOLUTION OF THE LINDLEY EQUATIONS FOR THE m-GROUP REGRESSION PROBLEM Progress report, Oct. 1977 - May 1978
Ivo W. Molenarr (Groningen Univ., the Netherlands) and Melvin R. Novick 1 Jun. 1978 53 p refs
(Contract N00014-77-C-0428; rr0420401; NR Proj. 150-404)
(AD-A057699; TR-78-3) Avail: NTIS HC A04/MF A01 CSCL 12/1

This paper presents a solution to the Lindley equations (Lindley and Smith, 1972) for an m-group regression problem. The present model is more efficient than earlier versions from the point of view of both computer CPU time and memory. The present solution lends itself to implementation on smaller computer systems. An explanation of the solution is presented, as well as directions for its implementation. Author (GRA)

N79-11826# Oklahoma State Univ., Stillwater. Coll. of Business Admin.
MONTE CARLO BAYESIAN SYSTEM RELIABILITY AND MTBF-CONFIDENCE ASSESSMENT, II, VOLUME 2. SPARCS-2 USERS MANUAL Final Report, Mar. 1976 - Dec. 1977
Mitchell O. Locks and Ross Gregson Mar. 1978 51 p refs
(Contract F33615-76-C-3094)
(AD-A057278; AFFDL-TR-78-18-Vol-2) Avail: NTIS HC A04/MF A01 CSCL 14/1

This SPARCS-2 (Simulation Program for Assessing the Reliabilities of Complex Systems, Version 2) Users Manual provides the information and instructions for using the SPARCS-2 computer program. A glossary is included containing the general terminology and a description of the input terms. The manual also includes a general description of the program system capabilities and its operation as well as a listing of the specific functions performed by the program. In addition, sections containing usage instructions and control or operating instructions are also included. These instructions cover areas such as: data input format, formalized deck structure, and the procedure for putting SPARCS on a load module and for executing the stored program. Two example cases are also included which demonstrate setting up a problem, the input data deck, and the resulting output of the analysis. Author (GRA)

N79-11827# Decisions and Designs, Inc., McLean, Va.
ON THE CREDIBILITY OF ESTIMATES: ITS EVALUATION AND IMPROVEMENT
Rex V. Brown Jun. 1978 43 p refs
(Contracts N00014-75-C-0426; N00014-78-C-0100)
(AD-A057270; TR-78-6-72) Avail: NTIS HC A03/MF A01 CSCL 12/1

The practical problem of appraising the accuracy of estimates--before or after they have been obtained--is analysed. A procedure called decomposed error analysis is proposed, which takes quantified assessments of different kinds of error, such as random sampling fluctuations and mismeasurement, and synthesizes them into a global assessment of error. It replaces and enlarges classical statistical inference approaches in a personalist format which does not depend on Bayesian updating. Applications from the private and public sector are presented.
Author (GRA)

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

No abstracts in this category.

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N79-11828 Adelphi Univ., Garden City, N. Y.
THE EQUIVALENCE OF SOME COMBINATORIAL MATCHING THEOREMS Ph.D. Thesis
Philip Francis Reichmeider 1978 165 p
Avail: Univ. Microfilms Order No. 7817479

The relationships among a class of Mengerian theorems (Menger's, Hall's, Konig's, Dilworth's, and the Integrity) are explored. The object of this work is to gather these relationships in one place and present them in a simple, straight forward manner. A number of proofs of these Mengerian theorems are presented. Matrix applications of Konig's theorem are included. Various interresting and useful forms of the Max-Flow Min-Cut theorem are considered. A brief exposition on the combinatorial implications of the duality theorem of linear programming is presented. Dissert. Abstr.

N79-11829 Alabama Univ., University.
STABILITY OF OPERATORS IN TOPOLOGICAL VECTOR SPACES Ph.D. Thesis
Charles Henry Copeland 1977 52 p
Avail: Univ. Microfilms Order No. 7819252

The stability of discrete dynamical systems in topological vector spaces is investigated in this work. The discrete dynamical systems studied are the solutions of difference equations of the form $x' = Ax$ or $x(n+1) = Ax(n)$. A Liapunov concept is developed in which both the range and domain spaces of the Liapunov functions may be topological vector spaces. The order theory required in the Liapunov function range space is developed. The dependence of the Liapunov method on order concepts is presented. The essential Liapunov machinery is developed and applied to Banach spaces to illustrate how stability may be used in spectral theory. Dissert. Abstr.

N79-11830 Texas Univ. at Austin.
HILBERT FUNCTIONS OF VECTOR SPACES OF FORMS Ph.D. Thesis
David Roy Berman 1978 66 p
Avail: Univ. Microfilms Order No. 7817615

A bound is given for the number of generators of ideals of a fixed finite colength. The proof is combinatorial and depends on a reduction by a theorem to ideals generated by the monimals. Level algebras and level sequences are defined. A study of numerical stability of a vector space of forms, V, are also presented. In an number of variables a proof is given that if V has codimension one or two and (V) is m-primary, then excess zero implies

numerical stability. The complete Hilbert function of V is defined. It is shown that there are finitely many Hilbert functions of a given degree and that there are finite number of vector space classes related to a given vector space. Dissert. Abstr.

N79-11831# Illinois Univ. at Urbana-Champaign, Urbana. Applied Computation Theory Group.
FINDING THE INTERSECTION OF A SET OF N HALF-SPACES IN TIME 0 (nlogn)
F. P. Preparata and D. E. Muller Dec. 1977 21 p refs
(Contract DAAB07-72-C-0259; NSF MCS-76-17321)
(AD-A057560; ACT-7) Avail: NTIS HC A02/MF A01 CSCL 12/1

A set of n half-spaces in three-dimensional space is given and an algorithm for finding the common intersection in time O(nlogn) is developed. The intersection, if nonempty, is presented as a convex polyhedron. The algorithm is summarized as follows: (1) the half-spaces are placed in two sets depending upon whether they contain or do not contain the origin; (2) the half-spaces in each of these sets are dualized to points, and the convex hulls of the dualized sets are obtained in time O(nlogn); (3) since the half-space intersection is nonempty if and only if these two convex hulls are dispoint, a separating plane is found, also in time O(nlogn); (4) after applying a linear spatial transformation which maps the separating plane to infinity, the convex hull of the union of the two transformed convex hulls is the transformed intersection of the half-spaces. Since the latter can be found in time O(n), the overall running time of the procedure is O(nlogn). A significant consequence of this result is that a three-variable linear, or convex, programming problem can be asymptotically solved faster than by the Simplex algorithm, in the worst case. GRA

N79-11832# Naval Postgraduate School, Monterey, Calif.
BASIC DIGIT SETS FOR RADIX REPRESENTATION Final Report
David W. Matula Jun. 1978 38 p
(AD-A057261; NPS-52-78-002) Avail: NTIS HC A03/MF A01 CSCL 12/1

The use of a negative base did not appear until the 1950s when several authors independently introduced the concept. Complement representation also became much discussed in this period as an alternative to sign magnitude for designing the arithmetic unit of a computer. The arithmetic of numbers represented in positional notation has a firm foundation derived from the theory of polynomial arithmetic that readily allows these extensions to negative bases and/or negative digit values, complement representation, and digit values in excess of the base. Our primary concern in this paper is the characterization and computation of those integral valued base and digit set pairs that provide complete and unique finite radix representation of the integers. GRA

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N79-11833# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering and Materials Sciences.
HIGH ORDER FINITE ELEMENT METHOD FOR THE CALCULATION OF CAPILLARY SURFACES
R. A. Brown Dec. 1977 29 p refs
(Contract W-7405-eng-48)
(LBL-7291) Avail: NTIS HC A03/MF A01

A reduced quadratic finite element method on quadrilaterals is developed for discretizing the capillary equation in regular and irregular domains. This method is used to solve the resulting set of nonlinear equations for the capillary surface. Numerical experiments are conducted for square and elliptical capillaries in order to compare this high-order method to a bilinear finite element-Newton scheme and a finite difference-dynamic alternating direction implicit (DADI) technique. The reduced quadratic finite element method is shown to be the most efficient in these tests due to the relatively coarse element grids that can be used for accurate approximations. DOE

71 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N79-11834 Johns Hopkins Univ., Baltimore, Md.
THREE DIMENSIONAL MEASUREMENTS OF ULTRASONIC WAVES IN SOLIDS Ph.D. Thesis
Steven Earl Fick 1978 140 p
Avail: Univ. Microfilms Order No. 7817939

An instrument was constructed to demonstrate the use of the Doppler shift suffered by the light intrinsically scattered within selected media. Experiments with single-frequency sinusoidal excitation of a 10 cm Plexiglas cube have confirmed the expected behavior of the system, verified the possibility of absolute calibration, and produced the first three dimensional measurements of sound fields that were highly complex, rather than highly ordered. Dissert. Abstr.

N79-11835 Alabama Univ., University.
TURBULENT BOUNDARY LAYER INDUCED BEAM STRESSES SIMULATED WITH A REVERBERANT ACOUSTIC FIELD Ph.D. Thesis
Luke Aloysius Schutzenhofer 1977 184 p
Avail: Univ. Microfilms Order No. 7819217

A methodology is described of simulating turbulent boundary layer fluctuating pressure induced stress response for a lightly damped, simply supported beam with a reverberant acoustic field. Normal mode vibration analysis was used with the excitation fields being specified empirically. The main results were developed in terms of dimensionaless quantities such as turbulent boundary layer spectrums, reverberant acoustical field simulation spectrums, and stress response spectrums for both excitation fields. These results were determined for various dimensionless parameters such as dimensionless fundamental frequency, Mach number, and relative boundary layer displacement thickness. From the dimensionless reverberant room simulation spectrums, the actual (dimensional) simulation spectrums can be determined from only a knowledge of the beam fundamental frequency, length of the beam, flow velocity, boundary layer displacement thickness, Mach number, and dynamic pressure. Dissert. Abstr.

N79-11836# Pennsylvania State Univ., University Park. Applied Research Lab.
DIFFRACTION EFFECTS OF BAFFLES ON ACOUSTIC DIRECTIVITY PATTERNS Ph.D. Thesis
W. Jack Hughes 12 Nov. 1977 173 p refs
(Contract N00017-73-C-1418)
(AD-A056292; TM-77-304) Avail: NTIS HC A08/MF A01 CSCL 20/1

The acoustic diffraction phenomena which occur at the edges of a baffle is investigated both experimentally and theoretically. Various sharp-edged and cylindrical-edged baffles were constructed in which geometry, impedance, and structural resonances were controlled. Data were obtained as a function of incident pressure, angle of incidence, and frequency, using two transducers, one in the far field and one on the baffle surface. Also investigated was the effect of placing small scattering barriers at the edge of rigid baffle surfaces. The Geometrical Theory of Diffraction was used to develop a theoretical model for the calculation of patterns. Both Sommerfeld and Malyuzhinets diffraction coefficients were discussed along with the utilization of a transition region function to remove singularities. Patterns obtained with rigid baffle surfaces exhibited ripples in the insonified region while soft baffles gave rise to a smooth 'bell-shaped' directivity pattern with highly attenuated diffraction fields. Asymmetric patterns resulted when a transducer was positioned close to one edge of a finite baffle. The good agreement obtained between theory and experiment confirms the validity of the Geometrical Theory of Diffraction. Author (GRA)

N79-11837# Science Applications, Inc., McLean, Va.
SAI SUPPORT OF THE ONR UPPER CRUST STUDY Final Report
J. S. Hanna 30 Nov. 1977 52 p refs
(Contract N00014-76-C-1049)

(AD-A056176; SAI-78-698-WA) Avail: NTIS HC A04/MF A01 CSCL 20/1

In the past few years, two substantial measurement programs (1,2) have been conducted for the purpose of measuring bottom loss in the low-frequency range below 1 kHz. Both programs have processed signals from explosive sources in various one-third octave bands and have used similar source-receiver geometries with both source and receiver within 300 to 800 feet of the ocean surface. For frequencies below 100 Hz, it is shown here that significant artifacts may be induced in the inferred bottom loss because of the combined choice of signal processing and source-receiver geometry. Furthermore, over the entire frequency range of interest, it is often likely that the inferred losses at low grazing-angle are contaminated by unsuspected incrustions of energy from the first convergence zone. GRA

N79-11838# Naval Research Lab., Washington, D. C.

SHALLOW WATER ACOUSTICS, PHASE 1

F. Ingenito, R. H. Ferris, W. A. Kuperman, and S. N. Wolf 27 Mar. 1978 57 p refs

(SF52552691)

(AD-A057691; AD-E000179; NRL-8179) Avail: NTIS HC A04/MF A01 CSCL 20/1

In response to the Navy's need for a submarine warfare capability in shallow water areas of the oceans, NRL has been conducting a research program in shallow-water acoustics. The goal of the first phase of this program has been to determine if wave theory can be used to predict the acoustic field at long ranges from a submerged acoustic source. The approach used an iterative process involving trial models and at-sea measurements. The wave equation for the physical model is solved by numerical methods and implemented on a high-speed general-purpose computer. Since the acoustic field at long ranges is propagated in the discrete normal modes of the duct, special experimental methods were used to resolve individual modal fields so that their measured characteristics could be compared with predictions. This report presents a detailed description of the NRL normal-mode model in its current form and describes the experimental evaluation procedures and results. Salient features of the model include variable sound speed in the water, slowly variable water depth, statistically rough boundaries, sediment layering, and both shear-wave and compressional-wave propagation in the bottom. Although certain recognized problems remain to be solved, it has been demonstrated that the model can in most cases predict the characteristics of the signal field with sufficient accuracy to be a useful tool in system design, performance prediction, and tactics. Author (GRA)

N79-11839# California Univ., Livermore. Lawrence Livermore Lab.

ACOUSTIC VELOCITY MEASUREMENT ACROSS THE DIAMETER OF A LIQUID METAL COLUMN

C. A. Calder and W. W. Wilcox 15 May 1978 19 p refs Presented at SESA Spring Meeting, Wichita, Kansas, 15 May 1978

(UCRL-81124; Conf-780565-1) Avail: NTIS HC A02/MF A01

An optical noncontacting method was developed for measuring sound velocity in liquid metals at extremely short experimental times and very high temperatures and pressure. This technique is incorporated into an isobaric expansion apparatus in which a 1 mm diam wire sample in a high pressure argon gas environment is resistively heated to melt within a time period of only a few microseconds. Before instability of the liquid column occurs, thermal expansion, enthalpy, and temperature are measured. The addition of the sound velocity measurement permits a more complete determination of the thermophysical properties of the liquid metal. DOE

N79-11840# Brown Univ., Providence, R. I. Dept. of Physics.

NONLINEAR SOUND GENERATION BY HIGH ENERGY PARTICLES

P. J. Westervelt 1978 6 p refs Presented at Neutrinos, Lafayette, Ind., 28 Apr. 1978

(Contract EY-76-C-02-2130)

(COO-3130TA-341; Conf-780453-2) Avail: NTIS HC A02/MF A01

In connection with Project DUMAND, the proposal to utilize the ocean as a giant acoustic detector of neutrinos, the applicability of a recent theory of thermoacoustic arrays was studied. In the static case or at very low frequencies, about 10 percent of the coefficient of thermal expansion for water at 20 C can be attributed to Debye-like modes. Debye-like modes generated sound via the nonlinear mechanism responsible for the operation of the parametric acoustic array. The contribution of the Debye-like modes to the thermal expansion coefficient and thus to the sound pressure was essentially independent of the ambient water temperature. Hence, if the Debye-like modes were not fully excited as was postulated to be the case at high frequencies, then the thermal expansion coefficient will be less than the static value by an amount that causes it to vanish at about 6 C instead of at 4 C, the temperature of maximum water density. This theory was in agreement with recent measurements of the temperature dependent of sound generated by proton deposition in water. DOE

N79-11841# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

DEFINITION AND REALIZATION OF A SPINNING MODE SIMULATOR

Jean-Michel Ville Feb. 1978 51 p refs In FRENCH; ENGLISH summary Report will also be announced as translation (ESA-TT-514)

(ONERA-NT-1977-9) Avail: NTIS HC A04/MF A01

The measurement of acoustic properties of materials in conditions close to those of their utilization (compressor inlet and outlet ducts) required the definition and realization of a device of cylindrical geometry allowing the study of these materials as a function of spatio-temporal characteristics of the acoustic field (frequency, angle of incidence) on the one hand, and on the other of the flow parameters (velocity, boundary layer). A numerical modelling of this device provides the excitation conditions (amplitude and phase) of the sources (compression chambers) whose axi-azimuthal distribution imposes simultaneously the axial and azimuthal wave number thence, consequently, the radial number. This way, a single mode chosen among all the propagative modes at the given frequency is engendered. The comparison of the spectra of axial and azimuthal wave numbers, measured and calculated for various values of the flow velocity, including zero velocity, as well as for various frequencies and incidence angles, made it possible to verify the working of this device and to know its limits. At this occasion, it has been possible to measure the convection effect of the flow on the axial wavelengths. A particular application of this device to the measure of the reflection coefficient of a material as a function of incidence angle is presented as an example. Author (ESA)

N79-11842# European Space Agency, Paris (France).

DEFINITION AND REALIZATION OF A SPINNING MODE SIMULATOR

Jean-Michel Ville Sep. 1978 70 p refs Transl. into ENGLISH of 'Definition et realisation d'un simulateur de modes tournants', ONERA, Paris Report ONERA-NT-1977-9, 1977 Original report in FRENCH previously announced as ESA-91091

(ESA-TT-514; ONERA-NT-1977-9) Avail: NTIS HC A04/MF A01

The measurement of acoustic properties of materials in conditions close to those of their utilization (compressor inlet and outlet ducts) required the definition and realization of a device of cylindrical geometry allowing the study of these materials as a function of spatio-temporal characteristics of the acoustic field (frequency, angle of incidence). A numerical modelling of this device provides the excitation conditions (amplitude and phase) of the sources (compression chambers) the axi-azimuthal distribution of which imposes, simultaneously, the axial and azimuthal wave number, and, consequently, the radial number. In this way, a single mode chosen from all the propagative modes at the given frequency is engendered. The comparison of the spectra of axial and azimuthal wave numbers, measured and calculated for various values of the flow velocity, including zero velocity, and for various frequencies and incidence angles, made it possible to verify the working of this device and to know its limits. It was also possible to measure the convection effect of the flow on the axial wavelengths. A particular application of this device to the measurement of the reflection coefficient

of a material as a function of incidence angle is presented as an example. Author (ESA)

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N79-11843 State Univ. of New York at Buffalo, Amherst.
THE THEORETICAL CALCULATION OF POTENTIAL ENERGY SURFACES Ph.D. Thesis
Marie Claire Flanigan 1978 201 p
Avail: Univ. Microfilms Order No. 7817032

Potential energy surfaces calculated using single determinant SCF molecular orbital theory exhibit cusps which arise form the intersection of two surfaces, cusps which do not appear on the exact surface. It is the presence of these cusps which classify reactions on these surfaces as 'forbidden' in the Woodward-Hoffmann sense. An ambiguity in the Woodward-Hoffmann rules exists however, for there are reactions which are forbidden along one reaction path yet are allowed along another path in the same symmetry even when the two paths connect the same reactant and product minima. The question that arises as to when and how the cusp disappears is addressed. To investigate this question, a two-electron, two-orbital model was constructed and the behavior of SCF single determinant wavefunctions in the vicinity of the cusp was studied. This model supplies the conditions under which a cusp can be terminated and adequately accounts for the apparent ambiguity in the Woodward-Hoffmann rules. Dissert. Abstr.

N79-11844 Yale Univ., New Haven, Conn.
LOW-ENERGY COLLISIONS OF SPIN-POLARIZED ELECTRONS AND SPIN-POLARIZED HYDROGEN ATOMS: ELASTIC SCATTERING AND IMPACT IONIZATION Ph D Thesis
Paul Frederick Wainwright 1977 210 p
Avail: Univ. Microfilms Order No. 7819550

Spin-dependent electron scattering experiments are important in physics because they yield information about quantities or effects which otherwise would not be observable. Two atomic physics measurements are reported: the elastic scattering of spin-polarized electrons by spin-polarized hydrogen atoms, and the impact of ionization of spin-polarized hydrogen atoms by spin-polarized electrons. The measurements were peformed in a crossed beams collision experiment. The polarized electron source was based upon the photoionization of unpolarized cesium atoms by circularly polarized light (the Fano effect). The results of the elastic scattering asymmetry measurements consisted of several 5 standard deviation measurements. Dissert. Abstr.

N79-11845 Pittsburgh Univ., Pa.
MICROWAVE AND SPECTROSCOPIC STUDIES OF RECOMBINATION CONTROLLED AFTERGLOWS Ph.D. Thesis
Yueh-Jaw Shiu 1978 71 p
Avail: Univ. Microfilms Order No. 7817282

The variation of alpha with Taube, when represented by a simple power law dependence, is found to be alpha equivalent to Taube to the -0.60 power for xenon, alpha equivalent to t sub e to the -0.55 power for krypton and alpha equivalent to t sub e to the -0.61 power for argon over the electron temperature range, 300 K less than or equal to T sub e less than or equal to 8500 K. At thermal energy, states of excitation energy up to but not exceeding the energy of the molecular ion in its ground electronic and vibrational state are observed to result from dissociative recombination. With microwave heating to T sub e equivalent to 8000 K, additional, higher-lying excited states of these three rare gases are produced. In both unheated and heated cases, transitions from the no groups (n= 6, 5, 4 for zenon, krypton and argon, respectively), which lie greater than or equivalent to 1 ev below the ground state of the molecular ion, are found to have the highest intensities. Dissert. Abstr.

N79-11846 California Inst. of Tech., Pasadena.
CASCADE OF NEGATIVE MUONS IN ATOMS Ph.D. Thesis
Victor R. Akylas 1978 79 p
Avail: Univ. Microfilms Order No. 7817467

The evolution of a negative muon captured in an atom and the formalism of energy loss associated with the muonic atom are studied. The principal goals are to calculate reliably the muon X-ray intensities, given the initial population of the muonic orbits, to invert the problem and deduce the initial distribution from the X-ray intensities, to provide the experimentalist with a reasonably simple and convenient tool to correlate his observations, and to systematize some questions of theoretical interest. The early part of the history of the muon matter, including the atomic capture and classical phase of the atomic cascade are reviewed. In the quantal treatment of the transition rates, both radiative and electron Auger transitions are considered. As a result of the investigation and in order to make the findings usable, a computer program was developed. Dissert. Abstr.

N79-11847 State Univ. of New York at Stony Brook.
MULTIPOINT DENSITY CLOSURES FOR MOLECULAR DIFFUSION IN TURBULENT TRANSPORT OF REACTIVE SCALARS Ph.D. Thesis
Ying-Yan Kuo 1977 108 p
Avail: Univ. Microfilms Order No. 7817565

The multipoint density closures for the molecular diffusion term in turbulent scalar transport with and without reaction in order to see more clearly the role played by molecular diffusion in closure approximations, the self diffusion process of a single scalar reactive species is considered. The closures of the one point probability density function equation are reviewed and criticized. In particular the closure approximation is examined in detail. It is proved that the two point probability density function obtained from levlev's closure is well defined. Preliminary numerical results are pursued. The idea of molecular mixing is defined in terms of the probability density function. For the case of initially binary distributions, it is proved that the two point probability density function describes correct molecular mixing behavior. Molecular mixing behavior is unable to be achieved in a natural way by the consideration of the one point probability density function. Dissert. Abstr.

N79-11848 Rochester Univ., N. Y.
MASTER EQUATION THEORY OF SIMULTANEOUS VIBRATIONAL RELAXATION AND INTRAMOLECULAR DECAY Ph.D. Thesis
Venkita Narayana Seshadri 1978 130 p
Avail: Univ. Microfilms Order No. 7818288

The usual probability conserving master equations used for describing vibrational relaxation were augmented by level dependent sink terms to incorporate intramolecular decay. Exact solutions of such master equations, involving the Montroll-Shuler relaxation rates and intramolecular decay terms which were linearly proportional to the vibrational energy, were obtained for several important initial distributions. The linearity of the decay rates was shown to be an exact result for purely radiative transitions under certain conditions and explicit expressions were obtained for the radiative decay rates under other conditions. Under linear decay, it was shown that a Boltzmann initial distribution was canonically invariant, giving rise to the concept of time dependent effective temperature of the excited state. Dissert. Abstr.

N79-11849 Yale Univ., New Haven, Conn.
OBSERVATION OF THE INFRARED SPECTRUM OF THE HYDROGEN MOLECULAR ION Ph.D. Thesis
Joseph John Spezeski 1977 164 p
Avail: Univ. Microfilms Order No. 7818101

The vibration-rotation spectrum of the hydrogen molecular ion HD(+) was observed with a novel method employing intersecting ion and laser beams, Doppler-effect tuning, and collisional detection. An electron-bombardment ion source was developed for the present work and features moderate current with low energy spread and molecular ions with low vibrational and rotational excitation. Collisional processes that exhibit vibrational-state dependence were studied experimentally and

proven useful for the detection of changes in the vibrational population of a molecular-ion beam. The ion source and collisional sector were used with a molecular-beam apparatus and frequency-stabilized CO laser to determine vibration-rotation transition frequencies for HD(+). Seven transition-frequency groups measured. Dissert. Abstr.

N79-11850# Army Armament Research and Development Command, Aberdeen Proving Ground, Md. Chemical Systems Lab.

CHAMBERS FOR THE ELECTRODYNAMIC CONTAINMENT OF CHARGED AEROSOL PARTICLES Technical Report, Jun. 1970 - Aug. 1971

Robert H. Frickel, Roy E. Shaffer, and James B. Stamatoff May 1978 61 p refs

(AD-A056236; AD-E410033; ARCSL-TR-77041) Avail: NTIS HC A04/MF A01 CSCL 20/8

Chambers capable of the electrodynamic containment of electrostatically-charged 20 to 100 micron-diameter particles have been constructed, along with (1) a device for introducing a preselected particle into the chamber and (2) a system for measuring the charge, size, and motion of the particle. One of the chambers contains two hemispheres and a central ring; in the other, the two electrodes are hyperboloidal. The latter chamber incorporates additional provisions for the precise control of the temperature and composition of the gas in the chamber. Measurements of the particle motion agree with theoretical calculations. Author (GRA)

N79-11851# Addis Translations International, Portola Valley, Calif.

CORRELATION BETWEEN ATOMIC TRANSITIONS: A NEW METHOD OF CALCULATION

P. Benoist, J. L. Bocquet, and P. LaFore Aug. 1977 30 p refs Transl. into ENGLISH from Acta Met. (US), v. 25, 1977 p 265-275 Prepared in cooperation with Battelle Pacific Northwest Labs., Richland, Wash.

(BNWL-TR-256) Avail: NTIS HC A03/MF A01

A rigorous method permitting an exact calculation of the correlation by means of a double Fourier-Laplace transformation is presented. This new method was created that makes it possible simultaneously: to reformulate synthetically all the correlation problems previously treated sporadically in the literature, to treat problems never yet solved (effect of the concentration of vacancies on the correlation factor; and self-diffusion by dissociated interstitial. DOE

N79-11852# Los Alamos Scientific Lab., N. Mex.

GENERAL-PURPOSE HEAT SOURCE PROJECT, SPACE NUCLEAR SAFETY PROGRAM, AND RADIOISOTOPIC TERRESTRIAL SAFETY PROGRAM Progress Report, Apr. 1978

R. D. Baker, comp. May 1978 42 p

(Contract W-7405-eng-36)

(LA-7319-PR) Avail: NTIS HC A03/MF A01

Research progress related to the use of (PU-238)O2 in radioisotopic power systems. Topics covered include clad temperature for reentry, design impact tests, fuel development, mechanical properties of graphite, container materials, environmental chamber experiments, plutonium uptake in growing plants, condensate collection system, fuel form exposure in various environments, systems support, safety engineering, and fuel feed materials. DOE

N79-11853# Max-Planck-Institut fuer Stroemungsforschung, Goettingen (West Germany).

ADIABATIC POTENTIALS AND DIABATIC MATRIX ELEMENTS FOR THE ALKALI MERCURY SYSTEMS Na, K, Rb AND Cs

R. Dueren Sep. 1977 37 p refs

(MPIS-12/1977) Avail: NTIS HC A03/MF A01

Full listings of the adiabatic potentials and the diabatic matrix elements are given for the interaction of Na, K, Rb, and Cs with Hg, from which full calculations of the cross sections for the excitation cross sections and for the interaction of the excited species in the P-states can be performed. For Na-Hg three sets of potentials are given; the first one, together with K-Hg, Rb-Hg, and Cs-Hg, satisfies the measurements of the ground state interaction. The interaction of Na with Hg in the excited state was also investigated by measuring the differential cross section for a laser excited beam of Na. The potentials fitted to the ground state measurement will not quantitatively describe the interaction in the excited state. This is achieved with the potentials given as a second listing for Na-Hg. In this calculation however, the ground state is not accurately described. Therefore the third listing for Na-Hg gives a compromise which satisfies both the excited state and the ground state interaction as much as possible. Author (ESA)

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N79-11854 Cornell Univ., Ithaca, N. Y.

EXCLUSIVE ELECTROPRODUCTION OF PHI AND LAMBDA (1520) Ph.D. Thesis

Christopher Timothy Day 1978 140 p

Avail: Univ. Microfilms Order No. 7817788

As part of the experimental program of the Large Aperture Magnet Experiment at the Cornell University Wilson Synchrotron, 11.5 GeV electrons were scattered from a liquid hydrogen target. Charged particles exiting from the reaction were detected in a 2 ft x 4 ft x 8 ft volume filled with wire proportional chambers and a 0.8 Tesla magnetic field. The trigger system required that the scattered electrons have undergone a four momentum transfer of at least -0.5 GeV squared. From these events were selected a subset satisfying the final state hypothesis (e p k superscript +superscript-) (ep K + K-). From this sample, cross sections for the production of the phi meson and lambda (1520) hyperon were extracted. The results are consistent with vector meson dominance within the modest statistics. Dissert. Abstr.

N79-11855 Adelphi Univ., Garden City, N. Y.

EIGENSOLUTIONS FOR A RELATIVISTIC POSITIVE ENERGY WAVE EQUATION Ph.D. Thesis

Kurt Fisher 1978 256 p

Avail: Univ. Microfilms Order No. 7817476

The solution, in spherical symmetry, of a relativistic, positive energy, spin 1-2 wave equation is found. The general solution is presented as a superposition of angular momentum states. A particular solution was found, which represents the state ml = 0, ms = mj = 1/2. It is a plane wave decomposition and is given in closed form. Using this plane wave solution, a differential scattering cross section, in the Born approximation, is computed. The cross section for the Staunton particle is found to be slightly larger than the conventional Mott cross section. The difference between the Staunton and Dirac particle cross sections is due to differences in internal structure. The group properties of the solution were also studied. A series of appendices details the derivations of the major results, including a check of the closed form solution. Dissert. Abstr.

N79-11856 Cornell Univ., Ithaca, N. Y.

ELECTROPRODUCTION OF THE rho MESON Ph.D. Thesis

Leif Anderson Ahrens 1978 133 p

Avail: Univ. Microfilms Order No. 7817818

The experiment was triggered by a shower counter physically located so as to insure that the scattered electron had suffered a large four-momentum transfer. By applying a four-constraint fit to those events having four final state tracks and no net charge, a clean subset satisfying the hypothesis e p pi superscript + pi superscript - was obtained. Within the kinematic region .7 Gev squared less than Q squared less than 3 Gev squared and 5 Gev squared less than W squared less than 14 Gev squared the behavior of the rho component of this final state was studied. The dependence of the cross section on Q squared, W squared and t are presented, as are some results from the study of the decay angular distribution of the rho. The conclusions drawn are that the simple vector meson dominance formula for

the Q squared dependence of the rho cross section agrees with the data for a W squared of 6 Gev but substantially overestimates the cross section for a W squared near 10 Gev squared.
Dissert. Abstr.

N79-11857 Cornell Univ., Ithaca, N. Y.
ELECTROPRODUCTION OF OMEGA MESONS Ph.D. Thesis
James Thomas Linnemann 1978 165 p
Avail: Univ. Microfilms Order No. 7817796

Data from the Cornell Large Aperture Magnet Experiment (LAME) are presented. These data were taken at the Cornell 12 GeV electron synchrotron. The sample of those events consisting of a scattered electron, proton, and three pions in the final state are investigated, with the third neutral pion inferred through kinematic fitting. Ratios of omega meson to rho meson production rates are presented, and virtual photon cross sections as a function of Q to the 2d power, W, and t are obtained. The experiment as a whole is also described, with special attention to the writer's areas of responsibility, the proportional chamber gas system and the efficiency calculations.
Dissert. Abstr.

N79-11858 Princeton Univ., N. J.
INCLUSIVE PARTICLE DISTRIBUTIONS FROM THE PSI AND PSI PRIME DECAYS Ph.D. Thesis
Kirk Alfred Shinsky 1978 263 p
Avail: Univ. Microfilms Order No. 7818395

The results of an experiment which studied the inclusive distribution of particles produced from the psi (3095) and psi prime (3684) decays are presented. A single-arm magnetic spectrometer was employed which identified the species of each particle over the entire momentum range as well as determining the momentum of the particle to about 1.7 x p%, for the momentum, p, in GeV/c. The distributions for the different species of stable, charged hadrons are presented. A comparison is made between the inclusive hadron distributions from the resonance decays and from nonresonant e(+)e(-) annihilation. The charged multiplicity distributions associated with the hadrons are presented as well as the correlation of the average multiplicity with the spectrometer particle's momentum. The production of free, fractionally-charged quarks is also investigated. The spectra of gamma rays produced in association with a particle in the spectrometer are also presented. Dissert. Abstr.

N79-11859# RAND Corp., Santa Monica, Calif.
PULSED-POWER RESEARCH AND DEVELOPMENT IN THE USSR Interim Report
Simon Kassel May 1978 160 p refs
(Contract MDA903-78-C-0189; ARPA Order 3520)
(AD-A056635; RAND/R-2212-ARPA) Avail: NTIS HC A08/MF A01 CSCL 20/7

Part of a continuing study of Soviet R and D of high-current, high-energy charged-particle beams and their scientific and technological applications, this report discusses pulsed-power devices and elements, the basic means of energy delivery to all charged-particle beam systems. Specifically, it treats pulsed-power generation, storage, and switching. Soviet technical literature since 1960 was examined for data detailing both the organization and planning of Soviet pulsed-power R and D and the theory, testing, and operation of pulsed-power equipment. The author concludes that the USSR is engaged in a major effort to develop pulsed-power systems for controlled thermonuclear reactions as a national energy source and military applications. Appendixes list pulsed-power facilities and published staff authors by research area and alphabetical order. Author (GRA)

N79-11860# Los Alamos Scientific Lab., N. Mex.
NUCLEAR REACTORS FOR SPACE ELECTRIC POWER
D. Buden Jun. 1978 37 p refs
(Contract W-7405-eng-36)
(LA-7290-SR) Avail: NTIS HC A03/MF A01

High-temperature, compact, fast reactors that can be coupled with various radiation shielding systems and thermoelectric, dynamic, or thermionic electric power conversion systems with lifetimes of 7 to 10 yr at full power, at converter operating temperatures of 1275 to 1675 K, are considered. Systems are being designed such that no single failure modes exist that will cause a complete loss of power. Design features in the reactor ensure that accidental criticality cannot occur. The major proposed applications for satellites with reactors in Earth orbit are in geosynchronous orbit (19,400 nautical miles). In missions in geosynchronous orbit, where orbital lifetimes are practically indefinite, the safety considerations are negligible. The potential missions, the question of why reactors are being considered as a prime power candidate, reactor features, and safety considerations are discussed. DOE

74 OPTICS

Includes light phenomena.

N79-11861 Johns Hopkins Univ., Baltimore, Md.
THE STUDY OF LIGHT INTENSITY FLUCTUATIONS IN TURBULENT MEDIA BY PHOTOCOUNTING TECHNIQUES Ph.D. Thesis
Antolin Julian Gonzalez-Del-Valle 1978 303 p
Avail: Univ. Microfilms Order No. 7817945

The statistics of the intensity fluctuations of laser light propagated through laboratory-produced turbulent channels was studied experimentally in terms of photocounting probabilities and normalized photocount factorial moments. A model for the probability density function of the intensity of laser light in a clear turbulent medium a truncated or nontruncated three-parameter log-normal density developed. The validity of this model was experimentally verified under a variety of conditions of turbulence strength, aperture averaging, propagation path, and beam geometry. General expressions for dead-time corrections or any order to measured photocount factorial moments are given and are applicable to photocounting studies of other kinds of fluctuating optical fields. Dissert. Abstr.

N79-11862 Yale Univ., New Haven, Conn.
ELASTIC AND INELASTIC LIGHT SCATTERING FROM SMALL SPHERICAL PARTICLES WITH PLANE WAVE AND EVANESCENT WAVE EXCITATION Ph.D. Thesis
El Hang Lee 1978 170 p
Avail: Univ. Microfilms Order No. 7819507

Experimental results on the polarization and angular distribution of fluorescence emission from small spherical particles containing fluorescent dye molecules are presented. The study, made in comparison with Lorenz-Mie scattering and with dye solution fluorescence, presents the characteristic dependence of particle fluorescence on the particle size, polarization, and refractive index of the medium. The importance of this research lies in its application to aerosol pollution monitoring. Also, the polarization and angular distribution of elastic and inelastic light scattering from dye solution and fluorescent particles driven by evanescent waves are presented. Dissert. Abstr.

N79-11863 State Univ. of New York at Stony Brook.
REFLECTION, SCATTERING AND EXCITATION BY GROOVES IN INTEGRATED OPTICS Ph.D. Thesis
Tsung-Yuan Hsu 1978 135 p
Avail: Univ. Microfilms Order No. 7819128

The reflection and radiation characteristics of a class of discontinuities in an optical surface wave guide are studied. These discontinuities, occurred in many practical devices in integrated optics such as filters, grating reflectors and couplers, include grooves with different profiles and geometric configurations in the guide and arrays which consist of a finite number of the grooves. A general formulation based on a boundary perturbation technique combined with the well-known coupled mode theory were developed to treat these scattering problems. The theory is concise and unified as it accounts for both TE and TM incident waves and finite array structures. Numerical results of many characteristic quantities such as reflection coefficient, radiated power, radiation patterns, coupling constants and coupling length were obtained. Dissert. Abstr.

N79-11864 Arizona Univ., Tucson.
IMAGE SAMPLING AND MULTIPLEXING WITH TWO-DIMENSIONAL PHASE GRATINGS Ph.D. Thesis
Paul Walter 1978 133 p

Avail: Univ. Microfilms Order No. 7818623

A novel diffraction technique for spatially modulating images for the purpose of image sampling is investigated for both rectangular and hexagonal sampling lattices. The method involves a coherent spatial filtering technique employing two-dimensional binary phase gratings to redistribute the energy in an image for improved detection at or near the coherent diffraction sampling limit. A spatial multiplexing technique can be used to increase the spatial frequency of the sampling lattice. High efficiency is achieved by using only phase elements. The method can be used with either temporally broadband or narrow band illumination with objects of arbitrary spatial coherence. The study explores the effects of broadband illumination and manufacturing errors, as well as advantages and disadvantages of alternative sampling systems in terms of signal-to-noise considerations, MTF, simplicity, color effects etc. Dissert. Abstr.

N79-11865* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SYSTEM FOR THE MEASUREMENT OF ULTRA-LOW STRAY LIGHT LEVELS Patent

Charles L. Wyman, Donald B. Griner, William A. Hurd (Sperry Rand Corp., Huntsville, Ala.), Glenn B. Shelton (Sperry Rand Corp., Huntsville, Ala.), Gary H. Hunt (Sperry Rand Corp., Huntsville, Ala.), Bill B. Fannin (Ariz. Univ., Tucson), Robert P. Brealt (Ariz. Univ., Tucson), and Charles A. Hawkins, inventors (to NASA) Issued 25 Jul. 1978 9 p Filed 29 Dec. 1976 Supersedes N77-14842 (15 - 05, p 0675)

(NASA-Case-MFS-23513-1; US-Patent-4,102,580; US-Patent-Appl-SN-755323; US-Patent-Class-356-210; US-Patent-Class-356-124) Avail: US Patent Office CSCL 20F

An apparatus is described for measuring the effectiveness of stray light suppression light shields and baffle arrangements used in optical space experiments and large space telescopes. The light shield and baffle arrangement and a telescope model are contained in a vacuum chamber. A source of short, high-powered light energy illuminates portions of the light shield and baffle arrangement and reflects a portion of same to a photomultiplier tube by virtue of multipath scattering. The resulting signal is transferred to time-channel electronics timed by the firing of the high energy light source allowing time discrimination of the signal thereby enabling the light scattered and suppressed by the model to be distinguished from the walls and holders around the apparatus.

Official Gazette of the U.S. Patent Office

N79-11866*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

NONCONTACTING METHOD FOR MEASURING ANGULAR DEFLECTION Patent Application

Emmett L. Bryant, inventor (to NASA) Filed 23 Oct. 1978 8 p

(NASA-Case-LAR-12178-1; US-Patent-Appl-SN-953390) Avail: NTIS HC A02/MF A01 CSCL 20F

An electro-optical means for measuring instantaneous angular deflections of an object without requiring mechanical contact with the object is described. A flat refractor is attached to the object whose angular deflections are to be measured. Light from a light source is passed through the first refractor onto a converging lens which converges the light through a second refractor onto a differential photocell. The output of the differential photocell is applied through a high gain amplifier to a galvanometer which is attached to the second refractor so that it rotates about an axis that is parallel to the axis of the first refractor. Any deflection of the object about the axis of the first refractor generates a current at the output of the photocell causing the galvanometer to rotate the second refractor to make the output of the photocell approach zero. This results in the galvanometer current being substantially proportional to the angular deflection of the object.

NASA

N79-11867# Illinois Univ. at Urbana-Champaign, Savoy.

ON COMPUTER STEREO VISION WITH WIRE FRAME MODELS Ph.D. Thesis

David Joseph Burr Dec. 1977 128 p refs

(Contract DAAB07-72-C-0259)

(AD-A057650; R-805; UILU-ENG-77-2251) Avail: NTIS HC A08/MF A01 CSCL 14/5

This report treats two major subproblems in computer stereo vision -- that of reconstructing 3-D scenes from stereo sets of images and automatic recognition of 3-D scenes. Two techniques are presented for scene reconstruction. The first, or multiple view method, utilizes the combined information from bulk correlation and three or more stereo images to construct three-dimensional edge features or structures. The structure is obtained by projecting into space a piecewise-linear representation of intensity edges obtained from one of the images. The second technique utilizes a narrow angle pair (2-3 degrees) of images and symbolic correlation to ensure matching reliability and efficiency in the construction of edge depth maps of scenes. A new technique of dynamic smoothing of edge contours is presented which permits accurate triangulation at narrow viewing angles, while preserving the integrity of sharp corners. Also, two new techniques are presented for piecewise approximation of 3-D and 2-D digital contours with circular arcs. GRA

N79-11868# Massachusetts Univ., Amherst. Dept. of Computer and Information Science.

SEGMENTATION USING SPATIAL CONTEXT AND FEATURE SPACE CLUSTER LABELS Interim Report

Paul A. Nagin May 1978 56 p refs

(Contract N00014-75-C-0459)

(AD-A056634; COINS-TR-78-8) Avail: NTIS HC A04/MF A01 CSCL 20/6

The focus of this paper is on image segmentation processes, collectively referred to as a 'low-level' vision system. The programs which will be discussed here transform a large spatial array of pixels (picture elements) into a more compact representation through the exploitation of visual features, e.g., intensity, color, texture, etc. The goal is to detect a relative feature invariance across an area of the image and then to label all the pixels in any such area as belonging to the same region. Regions can be detected through global analyses (e.g., histogram clustering) which find interesting areas by ignoring the local textural configurations of the data, in conjunction with local analyses (e.g., relaxation) which act as a fine-tuning mechanism both to resolve global ambiguities and to accurately delimit region boundaries.

Author (GRA)

N79-11869# University of Southern Calif., Los Angeles. Dept. of Physics.

THE EARLY YEARS OF VACUUM UV RADIATION PHYSICS AT USC, A 30TH ANNIVERSARY Final Report, 1 Jul. 1972 - 31 Dec. 1976

Gerhard L. Weissler 1 May 1978 158 p refs

(Contract N00014-76-C-0103)

(AD-A056608; USC-VAC-UV-200) Avail: NTIS HC A08/MF A01 CSCL 20/6

This final report summarizes the general area of research done during the 30 year period from 1947 to 1977, and it gratefully acknowledges the continuing sympathetic and financial support of the Office of Naval Research during this long period. Without this support, the research reviewed here would have been severely limited. The main body of the report is divided into essentially two parts: 'Photoionization in Gases' and 'Optical and Photoelectric Effects in Solids.' While this material is generally in the nature of a survey, ordered in historical sequence, the last few years from 1972 to 1977 on 'Plasma Research' are dealt with in some detail in Section 2 h in order to satisfy the formal requirements of this Final Report. Two lists of references are appended, and a total of about 200 individual references are listed. Author (GRA)

N79-11870# Honeywell, Inc., Golden Valley, Minn. Ceramics Center.

MANUFACTURING METHODS AND TECHNOLOGY FOR OPTICAL FABRICATION Quarterly Report, 28 Sep. 1977 - 1 Feb. 1978

William B. Harrison, G. Hendrickson, F. Johnson, E. Able, and J. Starling Jul. 1978 93 p refs

(Contract DAAB07-77-C-0615)

(AD-A058113; HONEYWELL-47356; QR-1) Avail: NTIS HC A05/MF A01 CSCL 20/6

This is the first quarterly report on the program, 'Manufacturing Methods and Technology for Optical Fabrication.' The program

was initiated to develop low-cost techniques for the fabrication of germanium spheric and aspheric lenses and mirrors for FLIR optical systems. Several form-to shape lens fabrication techniques, including casting and hot deformation are being examined for their cost-saving potential. Examples of both materials have been obtained in this initial period of effort. The use of single point diamond turning of aspheric surfaces will also be examined after completion of an initial effort with flats produced by the various form-to-shape processes. Author (GRA)

N79-11871# Los Alamos Scientific Lab., N. Mex.
INFRARED DETECTORS FOR USE AT 10 MICRONS
Elliot Eichen and Nelson Jarmie May 1978 8 p refs
(Contract W-7405-eng-36)
(LA-7276-MS) Avail: NTIS HC A02/MF A01

The characteristics of infrared detectors for use at 10 microns are presented in tables. Current commercially available and some developmental state-of-the-art units are listed. Both fast and slow detectors are covered. Definitions of the characteristics are given and extensive footnotes are included for clarification. DOE

N79-11872# Engins Matra, Velizy (France). Instrumentation Dept.
COMPLEX MIRROR STUDY FOR THE ESA ASTROMETRY PROJECT
D. Kaplan Paris ESA 6 Mar. 1978 78 p
(Contract ESA-3408/77-F-HGE(SC))
(Rept-60/433; ESA-CR(P)-1085) Avail: NTIS HC A05/MF A01

The design of a complex three splitted mirror was studied. A thermal model analysis was made, taking into account the latest baffle configuration and the extreme operational conditions (the entrance of the spacecraft in eclipse coming from a full solar illumination). A maximum change in the steady state gradients was obtained and the values of between the most relevant nodes and the gradient variation between these nodes are given as a function of time. A mechanical deformation model was set up to give an idea of the surface distortion and to assess which variation of the basic angle due to deformation may happen. Two manufacturing processes were envisaged, one a three block device stuck on a base plate and the other a U-shaped block with a stuck-in central part. The realization of the deformed profile is detailed. A vacuum deposition technique with a special rotating mask was used. It is concluded that the complex mirror device is feasible depending on the tolerances necessary to accommodate the three participating faces. ESA

N79-11873# National Technical Information Service, Springfield, Va.
NIGHT VISION DEVICES. CITATIONS FROM THE NTIS DATA BASE Progress Report, 1964 - Jul. 1978
Guy E. Habercom, Jr. Sep. 1978 279 p Supersedes NTIS/PS-77/0858; NTIS/PS-76/0729; NTIS/PS-75-647; NTIS/PS-75/055
(NTIS/PS-78/0933/8; NTIS/PS-77/0858; NTIS/PS-76/0729; NTIS/PS-75/647; NTIS/PS-75/055) Avail: NTIS HC $28.00/MF $28.00 CSCL 17E

Various types of night vision devices are investigated in these Government-sponsored research reports. Most were developed for military applications but they can readily be adapted for civil usage, as, for example, law enforcement. Abstracts on display screens, equipment design and effectiveness, electronic components, spurious noise reduction, and test methods are cited. This updated bibliography contains 273 abstracts, 28 of which are new entries to the previous edition. GRA

N79-11874# National Technical Information Service, Springfield, Va.
NIGHT VISION DEVICES. CITATIONS FROM THE ENGINEERING INDEX DATA BASE Progress Report, 1970 - Jul. 1978
Guy E. Habercom, Jr. Sep. 1978 82 p
(NTIS/PS-78/0934/6) Avail: NTIS HC $28.00/MF $28.00 CSCL 17E

Various devices are investigated in these abstracts of reports gathered in a worldwide literature survey of professional and industrial publications. Display systems, equipment design and effectiveness, electronic components, spurious noise reduction, and test methods are among the items researched. This updated bibliography contains 76 abstracts, 3 of which are new entries to the previous edition. GRA

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N79-11875 Texas Univ. at Austin.
A STUDY OF THE FOOT STRUCTURE OF PERPENDICULAR MHD COLLISIONLESS SHOCK WAVES Ph.D. Thesis
Timothy Lou Pittman 1978 243 p
Avail: Univ. Microfilms Order No. 7817694

An experimental study of the structure of collisionless, MHD shock waves propagating perpendicular into the bias field of a low beta plasma was performed on the oblique shock wave machine. The study focused on the formation of the double structure observed on the supercritical shock wave and the coincidental occurrence of ions reflecting from the shock wave. Shock waves in general are discussed beginning with a brief review of gas dynamic shocks to serve as a basis for understanding the more complicated plasma shock wave formation. The machine launched shock waves into a uniform preheated plasma. A comprehensive study of the shock wave was conducted using a variety of diagnostics including laser scattering and a complement of probes. Dissert. Abstr.

N79-11876 Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.
ANOMALOUS TRANSPORT COEFFICIENTS DUE TO THE ION-ION TWO-STREAM PLASMA MICROINSTABILITY Ph.D. Thesis
Robert Carl Backstrom 1978 183 p
Avail: Univ. Microfilms Order No. 7818601

The evolution of the explosive instability in a beam plasma system is investigated numerically using three computer models, a particle-in-cell simulation and two different fluid models. The results show that the interaction of three electrostatic waves with positive and negative energies indeed produces an instability with a growth rate faster than exponential in agreement with mode coupling theory. A treatment of the theory of the explosive instability, deduced from the one dimensional cold fluid equations for this system, is presented. Saturation mechanisms are discussed in some detail. The computer experiments indicate that the saturation of the instability is dominated by particle trapping rather than higher order wave-wave interactions. It turns out that the trapping of particles by the growing waves effectively heats the system causing a shift in the frequencies of the waves which, in turn, limits the instability. Dissert. Abstr.

N79-11877 Delaware Univ., Newark.
ELECTRON INJECTION INTO DENSE HYDROGEN, DEUTERIUM, AND NEON Ph.D. Thesis
Wayne Douglas Johnson 1978 159 p
Avail: Univ. Microfilms Order No. 7818572

Improved calculations of the anomalous transport coefficients due to the ion-ion two-stream plasma instability are presented. The coefficients describe the transfer of momentum and energy between the ion species by the electric fields generated by unstable waves. The calculations use electrostatic quasilinear theory in two dimensions to trace the time evolutions of the two ion species. The evolutions are continued until the transport coefficients reach their maximum values. The evolutions are done for homogeneous plasmas with warm ion beams and a single hot electron background distribution. The results of the evolutions indicate that a fair amount of momentum transfer from the debris to the air occurs when the relative velocity between them is less than the characteristic wave phase velocity of the plasma, the ion acoustic speed or the Alfven speed. On the other hand, little transfer occurs when the relative velocity is higher than the characteristic speed. Dissert. Abstr.

N79-11878 Auburn Univ., Ala.
A NUMERICAL STUDY OF THE EXPLOSIVE INSTABILITY

IN A BEAM-PLASMA SYSTEM Ph.D. Thesis
Michael Eugene Jones 1978 85 p
Avail: Univ. Microfilms Order No. 7818631

Electrons of a known energy distribution were injected into dense hydrogen deuterium, and neon, in both the liquid and gas phases. The density of the fluids was varied. The transmitted current for hydrogen and deuterium, as a function of the applied field was analyzed in terms of a diffusion model. The transmitted current in neon could not be explained by any of the available models. By injecting electrons from a planar gold surface into dense hydrogen and deuterium, the surface barrier was determined experimentally for the first time. The density dependence of the barriers agrees well with a Wigner-Seitz calculation for molecular densities greater than 1x10 to the 22d power cm superscript-3. Dissert. Abstr.

N79-11879 California Inst. of Tech., Pasadena.
FLUCTUATIONS IN A TOKAMAK PLASMA Ph.D. Thesis
Randall Lynn Kubena 1978 120 p
Avail: Univ. Microfilms Order No. 7817468

An experimental investigation of low frequency floating potential fluctuations in a research Tokamak plasma using two spatially separated electrostatic probes was performed. The spectra, correlation length, and the phase velocity of the fluctuations in both the radial and azimuthal direction were determined. The propagation velocity in the toroidal direction was also measured and was found to be in the direction of electron current flow. The waves traveled azimuthally in the ion diamagnetic drift direction, even after the usual E x B rotation was taken into account. The electron density fluctuations associated with these oscillations were large. The spectra were found to have regularly spaced peaks which seemed to be related to specific azimuthal modes. Dissert. Abstr.

N79-11880 Rochester Univ., N. Y.
NONLINEAR SATURATION OF THE DISSIPATIVE TRAPPED ELECTRON INSTABILITY Ph.D. Thesis
Stefano Migliuolo 1977 144 p
Avail: Univ. Microfilms Order No. 7818277

The particles in the plasma are separated into three species: trapped electrons, whose behavior is governed by a drift-kinetic equation with a Krook-type collision operator, circulating electrons described by a simple Boltzmann response and ions which are treated via a viscous fluid equation with finite Larmor radius effects. For the models in which the Landau damping of the circulating electrons is absent, the analytical predictions for the amplitude of the saturated mode are in very good agreement with the experiment. The mechanism for saturation is then analyzed and discussed. When the Landau damping is considered, a drastic reduction in the predicted value of the amplitude is calculated; it is then argued that this is due to the periodicity of the system, a situation which may not closely correspond to the actual experimental conditions. Dissert. Abstr.

N79-11881 Texas Univ. at Austin.
TWO-DIMENSIONAL STRUCTURE OF THE TRAPPED ELECTRON MODE Ph.D. Thesis
William Howard Miner, Jr. 1978 117 p
Avail: Univ. Microfilms Order No. 7817683

The two-dimensional structure of the trapped electron mode is investigated numerically for the frequency range above the ion transit frequency and below the electron bounce frequency. In this frequency range, a quasi-slab model of the particle dynamics is employed, i.e., the ions are described by a slab model while the electrons are treated in the full toroidal geometry. The full two-dimensional structure of the mode is determined for a given set of parameters and in the absence of macroscopic effects. A parametric study is then done to determine the effects of variations in the poloidal wave number and shear parameter on the growth rate and structure of the mode. Finally, the physical model is somewhat simplified in order to determine the effects of variations in the macroscopic parameters on the mode structure and growth rate. Dissert. Abstr.

N79-11882 Princeton Univ., N. J.
EXPERIMENTAL AND THEORETICAL STUDIES OF PARAMETRIC INSTABILITIES NEAR THE ION CYCLOTRON FREQUENCY SINGLE AND MULTI-ION SPECIES PLASMAS Ph.D. Thesis
Masayuki Ono 1978 188 p
Avail: Univ. Microfilms Order No. 7818384

Experimental and theoretical studies are presented of parametric instabilities near the ion cyclotron frequency in single and multi-ion species plasmas. In order to impress a uniform electric field of sufficient amplitude in the ion cyclotron frequency range inside the plasma, a suitable induction coil structure was constructed. From the RF electric field measurements, it was found that the induction coil can indeed impress a uniform electric field of up to 15 V/cm inside the plasma. With this coil structure it was possible to investigate three types of parametric instabilities in the following range of plasma parameters: the magnetic field, the plasma density, the temperatures, and the pump frequency. Dissert. Abstr.

N79-11883 Yale Univ., New Haven, Conn.
TOKAMAK BOUNDARY LAYER DIFFUSION AND THE EFFECTS OF VERY THIN ELECTROSTATIC SHEATHS Ph.D. Thesis
Lynn Marie Anderson 1977 106 p
Avail: Univ. Microfilms Order No. 7818071

A boundary layer diffusion equation describing a steady state balance between flow along guiding center orbits to absorbing walls and diffusion from nonintersecting to intersecting orbits is derived for an axisymmetric Tokamak of arbitrary minor cross section. A phase space is introduced wherein each point represents a guiding center orbit labeled by the approximate constants of the motion. When the ffective collision frequency is much less the transit frequency on representative orbits near the wall, there is a pause space boundary layer adjacent to the separatrix between intersecting and nonintersecating orbits. The diffusion equation can be linearized and analytical solutions obtained by adapting the results of a magnetic mirror study. Dissert. Abstr.

N79-11884 Columbia Univ., New York.
THE IMPLODING TO EQUILIBRIUM OF HELICALLY SYMMETRIC THETA PINCHES Ph.D. Thesis
Nazih Nicholas Sharky 1978 137 p
Avail: Univ. Microfilms Order No. 7819430

The time-dependent, single-fluid, dissipative magnetohydrodynamic equations are solved in helical coordinates (r phi), where phi = theta-kz, k = 2pi/L and L is the periodicity length in the z-direction. The two-dimensional numerical calculations simulate theta pinches which have an iota = 1 helical field added to them. Given the applied magnetic fields and the initial state of the plasma, we study the time evolution of the system. The plasma is found to experience two kinds of oscillations, occurring on different time scales. These are the radial compression oscillations, and the slower helical oscillations of the plasma column. The plasma motion is followed until these oscillations disappear and an equilibrium is nearly reached. Hence, given the amplitude and the rise time of the applied magnetic fields, our calculations allow us to relate the initial state of a cold, homogeneous plasma to its final equilibrium state where it is heated and compressed. Dissert. Abstr.

N79-11885# Naval Research Lab., Washington, D. C. Plasma Physics Div.
MICROSTABILITY OF A FOCUSSED ION BEAM PROPAGATING THROUGH A Z-PINCH PLASMA Interim Report
P. F. Ottinger, D. Mosher, and S. A. Goldstein (Science Applications, Inc., McLean, Va.) Jun. 1978 24 p refs Sponsored in part by DOE
(AD-A057689; AD-E000183; NRL-MR-3784) Avail: NTIS HC A02/MF A01 CSCL 20/9

A beam-plasma system consisting of a focused light ion beam propagating through a Z-pinch plasma is analyzed for microinstabilities. Two instabilities are discussed, one driven by the relative streaming between beam ions and electrons and the other driven by streaming between plasma ions and electrons. Conditions for stability of both modes are derived and are used to demonstrate that ion beams appropriate for use in a pellet fusion device can be propagated to the pellet through a Z-pinch plasma without disruptive microturbulence. Author (GRA)

N79-11886# Oak Ridge National Lab., Tenn.
INTERACTION OF TEARING MODES OF DIFFERENT PITCH

IN CYLINDRICAL GEOMETRY
H. R. Hicks, B. V. Waddell, and B. Carrers Dec. 1977 56 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6096) Avail: NTIS HC A04/MF A01

The hypothesis that the major disruption in Tokamaks is due to the interaction of tearing modes of different pitch is examined. For a flat safety factor profile, the m = 3/n = 2 tearing mode, which is linearly unstable, is strongly destabilized nonlinearly by the m = 2/n = 1 mode. Other modes are nonlinearly destabilized, particularly the m = 1/n = 1 and m = 5/n = 3 modes. Due to the development of islands of many different pitches, the toroidal current density profile is severely deformed. The corresponding region of island activity can extend essentially from the plasma center to the limiter. Presumably, this deformation of the field lines can lead to rapid transport of heat and particles from the plasma center to the limiter. The destabilization of the m = 3/n = 2 mode and other odd m modes is significant because it may correspond to the observed vertical asymmetry of some of the major disruptions in PLT. DOE

N79-11887# Department of Energy, Washington, D. C. Office of Magnetic Fusion Energy.
OVERVIEW OF THE MAGNETIC FUSION ENERGY DEVELOPMENT AND TECHNOLOGY PROGRAM
Mar. 1978 31 p
(HCP/T3073-01) Avail: NTIS HC A03/MF A01

Controlled fusion research is discussed with emphasis on: (1) fusion system engineering and advanced design; (2) plasma engineering; (3) magnetic systems; (4) materials; (5) environment and safety; and (6) alternate energy applications. DOE

N79-11888# California Univ., Livermore. Lawrence Livermore Lab.
NON-LINEAR NUMERICAL STUDIES OF THE TEARING MODE Ph.D. Thesis
D. D. Schnack, Jr. Jan. 1978 234 p refs
(Contract W-7405-eng-48)
(UCRL-52399) Avail: NTIS HC A11/MF A01

A nonlinear, time dependent, hydromagnetic model was developed and applied to the tearing mode, one of a class of instabilities which can occur in magnetically confined plasma when the constraint of infinite conductivity is relaxed. The model is based on the eight partial differential equations of resistive magnetohydrodynamics. The equations are expressed as a set of conservation laws which conserves magnetic flux, momentum, mass, and total energy. These equations are then written in general, orthogonal, curvilinear coordinates in two space dimensions, so that the model can readily be applied to a variety of geometries. No assumption about the ordering of terms is made. The resulting equations are then solved by the method of finite differences on an Eulerian mesh. The model is applied to several geometries. DOE

N79-11889# Westinghouse Electric Corp., Pittsburgh, Pa. Fusion Power Systems Dept.
FOUR IGNITION TNS TOKAMAK REACTOR SYSTEMS: DESIGN SUMMARY
C. A. Flanagan, ed. Oct. 1977 178 p refs
(Contract W-7405-eng-26)
(ORNL/Sub-7117/25; WFPS-TME-071) Avail: NTIS HC A09/MF A01

Principal TNS objectives assumed included: (1) demonstration of ignition and burning dynamics; and (2) reactor technology forcing. The selection of an overall design approach for TNS is described. The choice of ignition plasma design conditions (principally size and confining field of axis) and the choice of toroidal field coil technology (resistive or superconducting windings) are discussed. Four TF coil types were examined; these included copper, NbTi,Nb3Sn, and a hybrid design employing nested coils of copper and NbTi. The four reference concepts using decision modeling techniques as a mechanism for selecting a preferred design approach for the TNS mission are compared. DOE

N79-11890# ECON, Inc., Princeton, N. J.
ECONOMICS OF FUSION RESEARCH
George A. Hazelrigg, Jr. 15 Oct. 1977 288 p refs
(Contract EG-77-C-02-4181)
(COO-4181-; ECON-77-158-2) Avail: NTIS HC A13/MF A01

The study recognized that a hierarchy of economic analyses of research programs exists: standard benefit-cost analysis, expected value of R and D information, and expected utility analysis. It was shown that standard benefit-cost analysis, as commonly applied to research programs, was inadequate for the evaluation of a high technology research effort such as fusion research. A methodology for performing an expected value analysis was developed and demonstrated. An overview of an approach to perform an expected utility analysis of fusion research is presented. In addition, a potential benefit of fusion research, not previously identified, is discussed, and rough estimates of its magnitude are presented. This benefit deals with the effect of a fusion research program on optimal fossil fuel consumption patterns. The results of this study indicated that it was both appropriate and possible to perform an expected value analysis of fusion research in order to assess the economics of a fusion research program. DOE

N79-11891# General Atomic Co., San Diego, Calif.
UNIVERSAL ACCESSIBILITY CURVES FOR LOWER HYBRID WAVES IN A PLASMA OF ARBITRARY ION COMPOSITION
M. P. Hacker and R. W. Harvey Apr. 1978 12 p refs
(Contract EY-76-C-03-0167-038)
(GA-A-14933) Avail: NTIS HC A02/MF A01

It is shown that the linear propagation of lower hybrid waves in a cold magnetized plasma of arbitrary ion composition may be modeled by propagation in a plasma composed of a single ion species with unit charge and an effective mass which depends on the composition of the actual plasma. As a result, universal curves displaying the effect of ion composition on accessibility for waves in the lower hybrid range of frequencies are obtained. DOE

N79-11892# Oak Ridge National Lab., Tenn.
STUDIES OF HYDROGEN-RECYCLE FROM THE WALLS IN TOKAMAKS USING A PLASMA-WALL INTERACTION SIMULATOR
R. E. Clausing, L. C. Emerson, and L. Heatherly 1978 16 p refs Presented at 3d Conf. on Plasma Interaction in Controlled Fusion Devices, Abingdon, England, 3 Apr. 1978
(Contract W-7405-eng-26)
(CONF-780431-7) Avail: NTIS HC A02/MF A01

The hydrogen recycle phenomena from 304L stainless steel was studied using a plasma wall interaction simulator. Low energy (30 to 200 eV) atomic and molecular hydrogen ions were used. The evolution rate from surfaces bombarded with a flux of 6 x 10 to the 15th power ions per sq cms has been measured for several conditions and appears to be limited by complex diffusion phenomena and perhaps, in some cases, by surface recombination rates. The evolution rate reveals effects due to diffusion from the highly supercharged near-surface region. Several mechanisms are discussed but it is not possible to clearly identify which one(s) are responsible for the prompt desorption process. DOE

N79-11893# Department of Energy, Washington, D. C. Div. of Laser Fusion.
DISTORTION OF PLASMA DIAGNOSTICS BY AN AMBIENT GAS
J. S. Pearlman and M. K. Matzen (Sandia Labs, Albuquerque, N. Mex.) Mar. 1978 21 p refs
(Contract EY-76-C-04-0789)
(SAND-78-0209) Avail: NTIS HC A02/MF A01

The effect of vacuum chamber background gas on the ion measurements of a laser-produced, expanding plasma is studied over a wide range of background gas pressures. Experimental measurements are compared with calculations from a coupled rate equation-hydrodynamics code. The code is used for a parametric study of the effect of background gas pressure on plasma diagnostic measurements. Charge exchange is found to be an important process in our diagnostics above vacuum chamber pressures of 0.00001 Torr. DOE

N79-11894# Los Alamos Scientific Lab., N. Mex.
DIAGNOSTIC FOR MEASUREMENT OF RADIATED ENERGY FROM A TOROIDAL PLASMA
R. B. Howell and H. J. Karr Jun. 1978 13 p refs
(Contract W-7405-eng-36)
(LA-7273) Avail: NTIS HC A02/MF A01

Impurity line radiation can be a serious loss mechanism for a plasma. A diagnostic was needed for measuring the radiation loss on ZT-S, a toroidal reverse field pinch, so that the loss could be compared with total energy loss from the plasma. In the techniques described the total number of photons emitted from the plasma and the average photon energy are found. The number of incident photons is measured by a calibrated detector that observes a limited region of plasma. The emission is measured from two different chords, and the optical properties of the system are used to obtain the total number of photons emitted from the plasma per unit time and per unit length. The average photon energy of the relative sensitivity of both the spectrograph and film vs wavelength is obtained. The time-integrated radiated power is compared with the total energy loss from the plasma. DOE

N79-11895# General Atomic Co., San Diego, Calif.
CARBON AND SILICON CARBIDE AS FIRST WALL MATERIALS IN INERTIAL CONFINEMENT FUSION REACTORS
G. R. Hopkins, R. J. Price, R. E. Bullock, J. A. Dalessandro, and N. B. Elsner Mar. 1978 110 p refs
(Contract W-7405-eng-48)
(GA-A-14894) Avail: NTIS HC A06/MF A01

An assessment of two first wall materials, H-451 nuclear graphite and chemical vapor deposited silicon carbide, is given. A compilation of materials properties is presented. Temperature profiles and limitations and stress distribution and effects are discussed. A discussion is given on the coupling of these ceramic materials to a metal, for enchancement of heat transfer from the first wall to the coolant circuits. DOE

N79-11896# TRW Defense and Space Systems Group, Redondo Beach, Calif. Dept. of Plasma Physics.
MICROWAVE MODELING OF LASER PLASMA INTERACTIONS Final Report
1 Feb. 1978 28 p refs
(Contracts EY-76-C-03-1281; E(04-3)-1281)
(SAN-128-1) Avail: NTIS HC A03/MF A01

The microwave simulation of laser plasma interaction is discussed. Energetic electron production in the microwave plasma interaction was studied by observing argon line emission stimulated by electron-ion collisions. Optical detection provides a non-perturbing diagnostic, free from spurious probe effects as rf rectification. The spatial dependence of emission is characterized by a very broad peak centered in the density plateau region. Superimposed on this peak is a series of narrower peaks located in the underdense region. These peaks correspond qualitatively with the Airy function like spatial dependence of the incident electromagnetic wave. DOE

N79-11897# California Univ., Livermore. Lawrence Livermore Lab.
REAL-TIME INTERFEROMETER PHASE DETECTION USING
D. S. Mendell Mar. 1978 13 p refs Presented at the NBS-IEEE Micro-computer Based Instrumentation Conf., Gaithersburg, Md., 12-13 Jun. 1978
(Contract W-7405-eng-48)
(UCRL-80902; Conf-780621-2) Avail: NTIS HC A02/MF A01

The basic design and philosophy is described of a real-time, interferometer phase-detection system used on the 2XIIB and TMX magnetic-fusion experiments at the Lawrence Livermore Laboratory. This diagnostics system is a satellite to a host computer and uses high-speed, emitter-coupled logic techniques to derive data on real-time phase relationships. The system's input signals can be derived from interferometer outputs over a wide range of reference frequencies. An LSI-11 microcomputer is the interface between the high-speed phase-detection logic, buffer memory, human interaction, and host computer. Phase data on a storage CRT is immediately displayed after each experimental fusion shot. An operator can interrogate this phase data more closely from an interactive control panel, while the host computer is simultaneously examining the system's buffer memory or arming the system for the next shot. DOE

N79-11898# California Univ., Livermore. Lawrence Livermore Lab.
EFFECT OF PLASMA SHIELDING ON THE FIDELITY OF MAGNETIC PROBE IN A PLASMA FOCUS ENVIRONMENT
O. S. Zucker Apr. 1978 22 p Presented at Conf. on Plasma Science, Monterey, Calif., 15-17 May 1978
(Contract W-7405-eng-48)
(UCRL-80933; Conf-780552-1) Avail: NTIS HC A02/MF A01

The fidelity is examined of a dielectric, encapsulated magnetic probe in the adverse plasma environment encountered in plasma focus experiments. The ionization of the surface of the probe produces a conductive layer that tends to shield it from external magnetic fields. The solution of the wave equation is used to show the allowed regions of conductivity, sigma, and thickness, d, for the ionized layer. The results show that as d approaches the penetration depth, delta = (omega, mu sigma)/ sup1/2/, severe attenuation and distortion results, rendering the probe useless. When d is much less than delta, only attenuation is encountered, which also may be too severe for use. Finally, an experiment is described, which allows the experimenter to determine the fidelity of the probe. DOE

N79-11899# Oak Ridge National Lab., Tenn.
MECHANISM FOR MAJOR DISRUPTIONS IN TOKAMAKS
B. V. Waddell, B. Carreras, H. R. Hicks, J. A. Holmes, and D. K. Lee Jun. 1978 18 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6213) Avail: NTIS HC A02/MF A01

A mechanism is proposed for the major disruption in Tokamaks that involves the nonlinear destabilization of odd m tearing modes by the m = 2/n = 1 tearing mode, where m and n denote the poloidal and toroidal mode numbers, respectively. The magnetic islands generated can extend across the plasma cross section. For resistivities of the order of magnitude of those in TOSCA and LT-3, the time scale for their appearance is consistent with the time for the major disruption. DOE

N79-11900# Oak Ridge National Lab., Tenn.
POLOIDAL MAGNETIC FIELD FLUCTUATIONS IN TOKAMAKS
B. Carreras, B. V. Waddell, and H. R. Hicks Jul. 1978 33 p refs
(Contract W-7405-eng-26)
(ORNL/TM-6403) Avail: NTIS HC A03/MF A01

Elementary nonlinear tearing mode theory in a two-dimensional cylindrical geometry is used to predict accurately the amplitude of the m = 2 poloidal magnetic field fluctuations (Mirnov oscillations) at the limiter of a Tokamak. The input required is the electron temperature radial profile from which the safety factor profile can be inferred. The saturation amplitude of the m = 2 tearing mode is calculated from the safety factor profile using a nonlinear sq delta analysis. This gives an absolute result (no arbitrary factors) for the amplitude of the perturbation in the poloidal magnetic field everywhere, in particular, at the limiter. An analysis of ORMAK and T-4 safety factor profiles (inferred from electron temperature profiles) gives results that are in agreement with the experimental data. DOE

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N79-11901 Oklahoma Univ., Norman.
INFRARED REFLECTIVITY, RAMAN SCATTERING, AND THE VIBRATIONAL DYNAMICS OF UNIAXIAL CRYSTALS AND MIXED CRYSTALS Ph.D. Thesis
Henry Floyd Nichols 1977 180 p
Avail: Univ. Microfilms Order No. 7815375

Topics covered include (1) the oblique angular dispersion in the near normal incidence infrared reflectivity spectra of calcite and NaNO3, (2)the microcrystalline reflectivity spectra in (Na-14)(NO3) and 99% enriched (Na-15)(NO3); (3) the vibrational modes of Na(C103) sub x(Br03)sub 1-x and Rb (C103) sub x(Br03) sub 1-x. Dissert. Abstr.

N79-11902 Alabama Univ., University.
INFLUENCE OF CRYSTAL STRUCTURE ON THE RADIATION DAMAGE OF IRRADIATED ORGANIC SINGLE CRYSTALS Ph.D. Thesis
Balaraman Kalyanaraman 1978 232 p
Avail: Univ. Microfilms Order No. 7819185

It is becoming increasingly clear that solid state effects play an important role in the production, stabilization and decay kinetics in irradiated organic single crystals. In the present work, the solid state effects are analyzed in terms of crystal packaging, hydrogen bonding and heavy atom substitution Molecules of the type CXF2CONH2(X = F. Cl and Br) were found by X-ray crystallography to pack in the crystal lattice in a manner such that the halomethyl groups are systematically rotationally disordered. Dissert. Abstr.

N79-11903 Texas Univ. at Austin.
THE RANDOM PHASE APPROXIMATION: THEORY AND APPLICATION Ph.D. Thesis
Guy Taylor Worth 1978 147 p
Avail: Univ. Microfilms Order No. 7817735

The Random Phase Approximation (RPA) is a method for directly computing electronic excitation energies using Hartree-Fock ground state orbitals and orbital energies. The singlet and triplet single-particle-hole pi-electronic spectra of the 2, 4, and 6 site conjugated linear polyenes predicted by the RPA using the Huckel-Hubbard and Pariser-Parr-Pople (PPP) model Hamiltonians are compared with exact pi-electron configuration interaction spectra in order to quantify the accuracy and expose the nature of the RPA. A systematic correlation energy correction for the RPA excitation energies is suggested and examined, and the low energy singlet, single-particle-hole spectra of the 12 site linear conjugated system predicted by the Huckel Hubbard and PPP RPA are presented. Dissert. Abstr.

N79-11904 Temple Univ., Philadelphia, Pa.
CHIRAL LIQUID CRYSTAL SUBJECTED TO ELECTRIC FIELDS Ph.D. Thesis
Liang-Jye Yu 1978 214 p
Avail: Univ. Microfilms Order No. 7817360

The nature of chiral nematic liquid crystals are investigated with respect to the following aspects: pitch-concentration relationship; angular dependence of the selective reflection wavelength of planar chiral nematics; and electric field effects on the helical structure when the field direction is both parallel and perpendicular to the helical axis. The formation of a helical structure upon the addition of a chiral component to a nematic is analyzed and found to be in good agreement with the phenomenological equation derived by Bak and Labes. The angular dependence of the selective reflection band of a cholesteric is found to be in good agreement with Fergason's equation. It is found that pitch is kept constant or increased stepwise in contrast to the cases of thick and free surface samples where pitch is increased continuously. Dissert. Abstr.

N79-11905 Delaware Univ., Newark.
SECONDARY ION EMISSION FROM COPPER UNDER INERT GAS ION BOMBARDMENT Ph.D. Thesis
Robert Glass Hart 1978 136 p
Avail: Univ. Microfilms Order No. 7818176

The energy distributions and yields of positive, isogeneous copper cluster ions emitted from polycrystalline copper subjected to noble gas ion bombardment in the energy range below 1 keV were studied in ultra-high vacuum using a 90 deg sector magnetic deflection mass spectrometer. The energy transfer in the first interaction between a bombarding ion and the target is demonstrated to be a strongly manifest in the energy distributions and yields of the copper cluster ions. From these results, it is evident that factors other than cluster stability influence the yields of copper cluster ions in low energy inert gas ion bombardment situations. A crude statistical model of cluster formation is proposed to account for the present observations. The validity of the binary collision model in predicting energy transfer in the scattering of low kinetic energy argon ions from a copper surface was also investigated. Dissert. Abstr.

N79-11906 Texas Univ. at Austin.
A THEORETICAL STUDY OF THE NEMATIC-SMECTIC C LIQUID CRYSTAL PHASE TRANSITION Ph.D. Thesis
Pilla Ackley Leitner 1978 91 p
Avail: Univ. Microfilms Order No. 7817670

The effect of the broken symmetry in the nematic-smectic C liquid crystal phase transformation on the nature of the transition is studied using a method which includes fluctuations in several models. Models with a range of numbers of orthogonal ways to leave the constant energy surface have first order transitions when there are fewer than four ways to leave the constant energy surface, and continuous transitions with mean field exponents when there are more than four ways. The effect on the transition of fluctuations of the director as well as of the density is studied in three dimensions. This more complex model exhibits a first order transition, but a dimensionless parameter u'/u, enters the calculation. When two limiting values of this parameter are considered, it is shown that the two cases have different transition temperatures and jumps in the amplitude of the order parameter. Dissert. Abstr.

N79-11907 Princeton Univ., N. J.
INELASTIC ELECTRON SCATTERING MEASUREMENTS OF CORE THRESHOLDS IN SIMPLE METALS Ph.D. Thesis
Susan Elizabeth Graber Slusky 1978 120 p
Avail: Univ. Microfilms Order No. 7818354

An inelastic electron scattering spectrometer was used to study the Lii, iii edge of sodium and magnesium, the Mii, iii edge of potassium, and the K edge of lithium. Energy loss spectra were acquired at several momentum transfer values. In the case of sodium, magnesium, and potassium, the threshold shape becomes more rounded as momentum transfer is increased. The data were analyzed with respect to the Mahan-Nozieres-DeDominicis theory of core thresholds. The values of the Mahan exponents for these metals, the likely extent of the contribution of one-body effects, the values of the Onodera exchange energy, and the portion of non-dipole transitions at non-zero momentum transfers are discussed. Dissert. Abstr.

N79-11908 Texas A&M Univ., College Station.
THEORETICAL STUDIES OF HEAT TRANSFER ACROSS INTERFACES Ph.D. Thesis
Milton Earl Lumpkin 1978 124 p
Avail: Univ. Microfilms Order No. 7817193

The two intimately related studies of interfacial heat transfer were performed. The first is a study of the Kaptiza conductance for one-dimensional systems; the second is a study of three-demensional interfacial three-phonon processes. When quantum materials are present, the values of the Kaptiza conductance predicted by the Khalantnikov acoustic mismatch theory are smaller than experimental values by an order of magnitude or more. In order to test the validity of the fundamental assumptions of the Khalatnikov theory, computer experiments were performed to evaluate the Kapitza conductance of perfectly clean systems. It was found that the Khalatnikov and modified Khalatnikov theories agree with the results of the computer experiments only to within an order of magnitude. This leads to the belief that the Khalatnikov theory is incomplete. It is also found that anharmonicity increases the Kapitza conductance of these lattices. An alternate expression for the Kapitza conductance which is derived using linear response theory is discussed and comments on computational difficulties which arise in its application are presented. Dissert. Abstr.

N79-11909 Wyoming Univ., Laramie.
LOW TEMPERATURE THERMAL CONDUCTIVITY OF LEAD-BISMUTH ALLOYS IN NORMAL AND SUPERCONDUCTING STATES Ph.D. Thesis
Warren Deal Wittekind 1978 94 p
Avail: Univ. Microfilms Order No. 7818948

Thermal conductivity in eight samples of lead alloyed with bismuth was measured as a function of temperature and magnetic field. The atomic percentages of bismuth in lead ranged from

0 percent to 20 percent which convered the face centered cubic phase. Temperatures were between 1.2 K and 10 K. Measurements were made in the normal and superconducting states as a function of temperature and at certain fixed temperatures as a function of magnetic field. The energy gap was used as an adjustable parameter to fit the lattice thermal conductivity in the superconducting state. The results demonstrate that this procedure is satisfactory to extend the theory to strong coupling superconductors. The results also indicate that phonon scattering by boundaries is not important in this temperature range, but that phonon scattering by dislocations is important.

Dissert. Abstr.

N79-11910 State Univ. of New York at Binghamton.
EFFECT OF HYDROSTATIC PRESSURE ON TRANSITION TEMPERATURE AND UPPER CRITICAL FIELD OF SUPERCONDUCTING INDIUM-IMPREGNATED POROUS GLASS Ph.D. Thesis
William John Standish 1978 167 p
Avail: Univ. Microfilms Order No. 7818062

Pure molten indium was poured into the pores of leached phase-separated alkali-borosilicate glass cylinders and allowed to cool under pressure. The pore diameter of the glass was found to be 38 plus or minus 2 A as determined by mercury porosimetry, and all samples had 95%-97% of the available porous volume filled. X-ray diffraction studies indicate that the indium retains its crystallinity in the pores. The mean transition temperature, measured with a four-terminal resistance method, was found to be enhanced over the bulk value by 17%, and to decrease less rapidly with pressure than it does for bulk indium or for thin indium films. The best fit to the temperature dependence of the upper critical field indicates that for pores of 38 A diameter, indium-impregnated porous glass exhibits a mixture of three-dimensional and one-dimensional superconductivity.

Dissert. Abstr.

N79-11911 Princeton Univ., N. J.
EXCHANGE NARROWING IN LOW-DIMENSIONAL CORRELATED SPIN SYSTEMS Ph.D. Thesis
Tin-Tack Peter Cheung 1978 160 p
Avail: Univ. Microfilms Order No. 7819239

The Kubo-Tomita theory of exchange narrowed electron paramagnetic resonance (EPR) is extended to low dimensional systems where the strong isotropic exchange J sub o is comparable to the thermal energy kT. The absorption profile is expressed in terms of a memory function thereby taking into account the slow decay of low dimensional spin correlations while bypassing the Kubo-Tomita assumption of Gaussian processes. The notion of life-time effect, that the EPR broadening interaction provides a cut off to the spin diffusion, is emphasized. Static spin correlations are handled by taking thermal averages over the dominant isotropic exchange whenever kT approximately J sub 0 is much larger than the Larmor frequency. The theory is applied to a quantitative analysis of the temperature and angular dependence of EPR lionewidth of the one dimensional nati antiferromagnet N(CH3)4MnC13(TMMC)at K band between 40< T< 300 K and to the two dimensional ferromagnets Pt(NH3)4 (PTA)CuCl4 and 1-3-propane diammonium (PDA)CuCl4, and to the two dimensional antiferromagnet PDAMnCl4. Dissert. Abstr.

N79-11912 Princeton Univ., N. J.
AN APPARATUS FOR THE STUDY OF TRANSMISSION ELECTRON SPIN RESONANCES AT ULTRA HIGH FREQUENCIES Ph.D. Thesis
Frank Anthony Chambers 1978 124 p
Avail: Univ. Microfilms Order No. 7819236

An apparatus was built to study transmission electron spin resonance (CESR) at ultra high frequencies, 345 MHz. Theory predicts the CESR linewidths adequately for copper, silver, and the alkalies but is not adequate to predict the linewidth for aluminum. A prediction for linewidth in aluminum is made based upon the present experimental data. Experiments were done with both aluminum and lithium. In both cases a very broad field dependent background was found. The background was approximately 1000 times the expected signal. This was sufficiently large to mask the CESR looked for. An upper limit for the power in the CESR was obtained in agreement with the theory. The background is thought to be a geometric cyclotron resonance and has a very broad linewidth. A geometry with H sub 0 in the plane of the sample and perpendicular to H sub 1 is suggested as a means of descriminating against this resonance. Other improvements are also suggested. Dissert. Abstr.

N79-11913 Catholic Univ. of America, Washington, D. C.
AN ELECTRON DIFFRACTION STUDY OF THE STRUCTURE OF AMORPHOUS SILICON OXIDE FILMS Ph.D. Thesis
Clifford Farquhar George, Jr. 1978 86 p
Avail: Univ. Microfilms Order No. 7818508

Amorphous silicon oxide films were investigated by high energy electron diffraction. Accurate scattering data were collected photographically for four films whose composition was determined to be SiO2, SiO1.27, SiO1.06, and SiO0.084. The radial distribution functions (RDF) obtained from the Fourier transformation of the interference functions were analyzed by a least squares procedure. The thin film SiO2 was observed to be composed of Si-O4 tetrahedra with an average Si-O separation of 1.606 A and an Si-O-Si bond angle of approximately 145 C. The overall bonding topology agrees well with that observed for bulk (vitreous) SiO2 as determined from X-ray diffraction. The thin film SiO1.27, SiO1.06, and SiO0.84 bonding topology, as determined by their respective short range order, was consistent with that expected for a mixture of tetrahedrally bonded amorphous Si and SiO2 phases in which the scale of the Si-like and SiO2-like regions is on the order of a few basic tetrahedral units. Dissert. Abstr.

N79-11914 California Univ., Santa Barbara.
SOME PHENOMENA IN MANY PARTICLE SYSTEMS FAR FROM EQUILIBRIUM Ph.D. Thesis
Walter Lawrence Bloss, III 1977 143 p
Avail: Univ. Microfilms Order No. 7819133

The Keldysh method for non-equilibrium systems (an extension of the ordinary Feynman diagrammatic technique for a equilibrium system to the non-equilibrium system) is introduced and applied to the damping of a simple harmonic oscillator in contact with a reservoir and an Anderson model with a time-dependent interaction. The rate of pion production from a nucleon, moving at a high velocity through infinite nuclear matter, is calculated by summing an infinite set of diagrams by the Keldysh method. The linear response answer is shown to be incorrect in this limit and an answer indicative of a rate equation approach is obtained. The charge exchange probability is calculated for ions scattering from solid surfaces, including interactions with both broad band delocalized electrons and with localized core electrons within an Anderson-type Hamiltonian with time dependent parameters. Dissert. Abstr.

N79-11915 Pennsylvania State Univ., University Park.
MANY-BODY AND SPIN-DEPENDENT SURFACE POTENTIAL EFFECTS IN SPIN-POLARIZED FIELD EMISSION Ph.D. Thesis
Douglas Daniel Nagy 1978 187 p
Avail: Univ. Microfilms Order No. 7818778

A spin dependent generalization of the Appelbaum-Brinkman transfer Hamiltonian method is developed and used to derive an expression for the spin-polarized current density in field emission from ferromagnets. For a given spin orientation, the current density depends on the spectral amplitudes for that spin orientation. The self-energy operators which determine the spectral amplitudes are approximated by local, energy independent, spin-diagonal potentials. Although spin-flip processes are thereby neglected, the detailed variation of the surface potential and an approximate account of many-body effects are included by means of an effective surface potential. The calculation of the effective surface potential by means of the spin-dependent generalization of the Kohn-Sham version of the Hohenberg-Kohn density functional formalism is described and numerical values are obtained for a bulk uniform background density and bulk spin polarization P appropriate for ferromagnetic Ni. Dissert. Abstr.

N79-11916 New York Univ., N. Y.
THE THERMODYNAMIC BEHAVIOR OF THE DISCRETE SPIN THREE-STATE POTTS MODEL AND ONE OF ITS VARIANTS Ph.D. Thesis
John Joseph Sudano 1978 176 p
Avail: Univ. Microfilms Order No. 7818468

In appropriate cubic crystal fields rare earth ions have a six-fold degenerate ground state. The cubic model which is a variant of the three state Potts model has been used to describe these types of systems. The three-state Potts model is readily obtained from the cubic model by removing the bilinear spin interaction. By using the tetrahedron cluster approximation a first order transition is obtained at the origin D1 = D2 = 0 at a temperature 10 percent lower than that found by MFA but only 1/2 percent higher than that found from series expansions. The discontinuity in the order parameter remains high at about 90 percent of that found from mean field calculations. Nonetheless the size of the first order coexistence surface for this model in the D1 D2 plane is only 4 percent of that predicted by mean field theory. These conflicting properties suggest that in the tetrahedron approximation the three state Potts model has a fluctuation dominated first order phase transition. Dissert. Abstr.

N79-11917 Temple Univ., Philadelphia, Pa.
SPIN TEMPERATURE STUDY OF NUCLEAR DYNAMIC POLARIZATION IN CRYSTALS OF CALCIUM FLUORIDE DOPED WITH YTTERBIUM Ph.D. Thesis
Sidney Schuster 1978 95 p
Avail: Univ. Microfilms Order No. 7817341

The study attempts to verify the theory of Abragam and Borghini based on the concept of spin temperature. The theory predicts the enhancement of nuclear polarization in solids in which a paramagnetic electron system is also present. Verification of this theory was sought using the substance CaF2 doped with Yb. By studying the epr lineshape of the Yb(3+) ions, its homogeneity, the bottleneck properties of the samples and measuring electron relaxation times, important parameters in the theory were determined and conditions were clarified which make the verification more meaningful. The theory shows that the position of the maxima are only slightly dependent on irradiation powers. Experiment confirms this to be the case. Theory also predicts the magnitudes of the enhancement maxima as a function of r-f power. Here, experiments shows order of magnitude agreement at low powers. For high powers, the experimental values are an order of magnitude smaller. Dissert. Abstr.

N79-11918 Clark Univ., Worcester, Mass.
EXPERIMENTAL STUDIES OF STATIC AND DYNAMIC CRITICAL PHENOMENA AND LATTICE DEFECTS IN Ni USING PERTURBED ANGULAR CORRELATIONS Ph.D. Thesis
Robert Merle Suter 1978 118 p
Avail: Univ. Microfilms Order No. 7819516

Solid state applications of the perturbed angular correlations (PAC) technique for measuring hyperfine interactions through detection of nuclear radiations are discussed. A precise measurement of the critical exponent in Ni using Rh-100 PAc was made. The disagreement of the result with theoretical calculations for the Heisenberg model is considered in terms of corrections to scaling. Nickel-copper alloys were measured using Cd-111 PAC. Results indicate that the order parameter exponent does change. Suggestions are made for improvements in the sample preparation technique which should eliminate any clustering of Cu. Critical slowing down of spin correlation times in Ni and Fe was measured by several hyperfine field techniques. It is hypothesized that hyperfine field measurements are dominated by fluctuations of wavevector smaller than those accessible to neuton scattering and that at these wavevectors, the usual theoretical model is inapplicable. The hyperfine field data are consistent with a model with a nonconserved order parameter. Lattice defect structures in Ni were also studied. Dissert. Abstr.

N79-11919 Temple Univ., Philadelphia, Pa.
A DYNAMICAL RENORMALIZATION-GROUP APPROACH TO THE SPIN-WAVE DAMPING IN A HEISENBERG FERROMAGNET Ph.D. Thesis
Hasan Zillur Rahim 1978 117 p
Avail: Univ. Microfilms Order No. 7817337

A renormalization group calculation is performed on a semi-microscopic Langevin equation of motion. A novel feature of the renormalization group is the appearance of relevant four-point vertices whose effect on the damping turns out to be of great importance but which cannot be incorporated into the traditional Langevin picture. The renormalization group is therefore treated within a purely diagrammatic framework. The fixed point of theory is determined and coupled recursion relations are found. From the asymptotic approach toward the fixed point, logarithmic corrections to the damping are obatined. The result is more generally valid than that found by the corresponding microscopic calculation because of the universality of the properties of the renormalization group. Dissert. Abstr.

N79-11920* National Aeronautics and Space Administration. Pasadena Office, Calif.
METHOD OF CONTROLLING DEFECT ORIENTATION IN SILICON CRYSTAL RIBBON GROWTH Patent
Martin H. Leipold, inventor (to NASA) (JPL) Issued 24 Oct. 1978 4 p Filed 16 Jul. 1976 Supersedes N78-23969 (16 - 14, p 1921) Sponsored by NASA
(NASA-Case-NPO-13918-1; US-Patent-4,121,965; US-Patent-Appl-SN-706073; US-Patent-Class-156-608; US-Patent-Class-156-617SP; US-Patent-Class-156-DIG.64; US-Patent-Class-156-DIG.65; US-Patent-Class-156-DIG.88) Avail: US Patent Office CSCL 20B

The orientation of twinning and other effects in silicon crystal ribbon growth is controlled by use of a starting seed crystal having a specific (110) crystallographic plane and (112) crystallographic growth direction.
Offical Gazette of the U.S. Patent Office

N79-11921*# Case Western Reserve Univ., Cleveland, Ohio. Engineering Design Center.
ADAPTATION OF ION BEAM TECHNOLOGY TO MICROFABRICATION OF SOLID STATE DEVICES AND TRANSDUCERS
James A. Topich Nov. 1978 40 p refs
(Grant NsG-3131)
(NASA-CR-159439) Avail: NTIS HC A03/MF A01 CSCL 20L

A number of areas were investigated to determine the potential uses of ion beam techniques in the construction of solid state devices and transducers and the packaging of implantable electronics for biomedical applications. The five areas investigated during the past year were: (1) diode-like devices fabricated on textured silicon; (2) a photolithographic technique for patterning ion beam sputtered PVC (polyvinyl chloride); (3) use of sputtered Teflon as a protective coating for implantable pressure sensors; (4) the sputtering of Macor to seal implantable hybrid circuits; and (5) the use of sputtered Teflon to immobilize enzymes. G.Y.

N79-11922# Army Armament Research and Development Command, Watervliet, N. Y. Benet Weapons Lab.
FOURTH ORDER ELASTIC CONSTANTS FOR SODIUM CHLORIDE TO 270 KBAR BY WAVE DYNAMICS
Moayyed A. Hussain, Julius Frankel, and Raymond D. Scanlon Mar. 1978 33 p refs
(DA Proj. 1L1-61102A-H60)
(AD-A056008; AD-E440008; ARLCB-TR-78005) Avail: NTIS HC A02/MF A01 CSCL 20/2

The dilatational and shear velocities and the equation of state for an isotropic material under high hydrostatic pressures by the methods of continuum mechanics using the theory of small deformation superposed on a finite strain have been derived. The strain energy density of the material is taken to fourth order in terms of the strain invariants. GRA

N79-11923# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
DIFFERENTIAL-HALL IMPURITY PROFILING OF GaAs CO-IMPLANTED WITH Ga(+), C(+) AND As(+), C(+) M.S. Thesis
Michael Stefiniw Oct. 1977 65 p refs
(AD-A057362; AFIT/GEO/PH/77-4) Avail: NTIS HC A04/MF A01 CSCL 20/12

Ion implantation is a relatively new method of doping GaAs semi-conductors but has been successfully used in devices with silicon substrates. It is a process by which impurity ions are accelerated by a particle accelerator and implanted into the substrate. The depth to which the impurity ions will penetrate is dependent upon the ion mass, energy of the beam and crystal orientation. After the implantation cyrstal lattice damage exists

which must be annealed by heat treatment. This process is also used to electrically activate the impurity ions for conduction by moving them into the crystal sites. However, the annealing temperature required to effectively do the job exceeds the temperature where the GaAs surface begins to decompose. To prevent or reduce this effect the sample is encapsulated by a dielectric layer of Si3N4, approximately 1000 angstrom thick. This layer is placed on the sample after implantation and before annealing. The dielectric layer is etched away when electrical measurements are performed on the sample. The guarded van der Pauw measuring system is used to acquire the crystal and Hall voltages of the samples. Electrical profiles are obtained on the 900 C annealed samples by a successive etching technique. GRA

N79-11924# National Bureau of Standards, Washington, D. C.
PIEZOELECTRICITY AND PYROELECTRICITY IN POLYVINYLIDENE FLUORIDE: A MODEL
M. G. Broadhurst, G. T. Davis, J. E. McKinney, and R. E. Collins Jul. 1978 30 p refs
(Contract N00014-78-C-0015)
(AD-A057355; TR-9) Avail: NTIS HC A03/MF A01 CSCL 11/9

A description is given of the molecular and morphological structure of polyvinylidene fluoride and from this description a classical model is proposed for calculating the piezo- and pyroelectric properties. The model consists of an array of crystal lamellae with a net moment from aligned dipoles in the crystals and compensating space charge on the crystal surfaces. The results for no compensation and complete compensation essentially bracket experimentally observed results and indicate that the largest contribution to the activity of this polymer arises from bulk dimensional changes, rather than from changes in molecular dipole moments. Author (GRA)

N79-11925# Illinois Univ., Urbana.
RAMAN STUDIES OF HYDROGEN VIBRATIONAL MODES IN PALLADIUM M.S. Thesis
R. Sherman 1978 76 p refs
(Contract EY-76-C-02-1198)
(COO-1198-1212) Avail: NTIS HC A05/MF A01

The phonon density of states of substoichiometric polycrystalline Pd-H(D) was investigated by Raman scattering above and below the 50 K anomaly. The Raman spectra for hydrogen and deuterium were found to be asymmetric and peaked at 58.5 MeV and 39.7 MeV, respectively, in near agreement with inelastic neutron scattering data. The scattering mechanism appears to require hydrogen-hydrogen interactions. No major changes in the optical spectra were observed in going through the 50 K anomaly. DOE

N79-11926# Ames Lab., Iowa.
CRITICAL CURRENTS OF A ONE-DIMENSIONAL ARRAY OF SUPERCONDUCTING VORTICES IN A PERIODIC PINNING POTENTIAL
J. R. Clem and P. Martinoli (Lab. fuer Festkoerperphysik, ETHZ, Zurich) 1978 8 p refs
(Contract W-7405-eng-82)
(IS-M-137) Avail: NTIS HC A02/MF A01

The static interaction of a vortex chain with a periodic pinning potential is presented. The critical currents for matching and nonmatching configurations of the array are deduced from a model based on the formation of a vortex-defect superlattice. It is shown that defects (vacancies or interstitials) along the vortex chain are essential to produce a significant pinning effect. DOE

N79-11927# Notre Dame Univ., Ind. Dept. of Metallurgical Engineering and Materials Science.
MINIMUM ENTROPY PRODUCTION PRINCIPLE AND OSTWALD RIPENING
G. C. Kuczynski Feb. 1978 17 p refs
(Contract EG-77-S-02-4385)
(COO-4385-1) Avail: NTIS HC A02/MF A01

A distribution function for the growth of particles in a medium capable of transmitting matter is derived from the general principle of minimum rate of entropy production. DOE

N79-11928# Cornell Univ., Ithaca, N. Y. Dept. of Materials Science and Engineering.
DIRECT OBSERVATION OF THE POINT-DEFECT STRUCTURE OF DEPLETED-ZONES IN ION-IRRADIATED METALS Ph.D. Thesis
C. Wei Jan. 1978 276 p refs
(Contract EY-76-S-02-3158)
(COO-3158-62) Avail: NTIS HC A13/MF A01

Four-pass zone-refined tungsten field-ion microscope specimens were irradiated in-situ at 10 K with 30 keV, Cr(+), Mo(+), or W(+) ions to a total dose of (2 to 10) x 10 to the 12th power ion/sq cm ion and examined by the pulse field-evaporation technique at 10 K. The experimental conditions were such that each depleted zone was created by a single incident-ion. The radial distribution function was determined for each depleted zone, it was found that the vacant lattice sites within the volume of each depleted zone tend to exist in a highly clustered state. The spatial distribution of self-interstitial atoms in a specimen irradiated with 30 keV Cr(+) ions and in a specimen irradiated with 18 keV Au(+) ions, at 10 K, was determined. The vacancy structure of a (220) platelet created by a single 30 keV W(+) ion in a platinum-4.0 at. percent gold alloy. DOE

N79-11929# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
WHISKER GROWTH: A NEW MECHANISM FOR HELIUM BLISTERING OF SURFACES IN COMPLEX RADIATION ENVIRONMENTS
W. R. McDonell 1978 10 p refs Presented at 3d Conf. on Plasma Interaction in Controlled Fusion Devices, Abingdon, England, 3 Apr. 1978
(Contract EY-76-C-09-0001)
(DP-MS-77-119; Conf-780431-8) Avail: NTIS HC A02/MF A01

Implantation of helium concurrent with the generation of large numbers of displaced atoms in surface layers of materials exposed to Cf-252 alpha particles and fission fragments produces a unique form of low temperature surface blistering. A basis for the whisker-growth mechanism for helium blistering is formulated as an aid to the specification of conditions under which the mechanism might apply. DOE

N79-11930# National Bureau of Standards, Washington, D. C. Electron Devices Div.
SEMICONDUCTOR MEASUREMENT TECHNOLOGY Progress Report, 1 Jul. - 30 Sep. 1976
W. Murray Bullis, ed. and J. Franklin Mayo-Wells, ed. Jul. 1978 82 p refs Sponsored in part by DARPA and SAMSO
(Contract E(49-1)-3300; N00164-76-MP-04511)
(PB-283482/8; NBS-SP-400-36) Avail: NTIS HC A05/MF A01 CSCL 20L

Contents: materials characterization by electrical methods; materials characterization by physical analysis methods; materials and procedures for wafer processing; photolithography; test patterns; assembly and packaging; device inspection and test; references; semiconductor technology program staff; semiconductor technology program publication; and solid-state technology and fabrication services. GRA

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N79-11931# Department of Energy, Bartlesville, Okla. Energy Research Center.
ENTHALPIES OF COMBUSTION OF exo-THDC, RJ-4, ISOMERIZED RJ-4, AND JP-9 Interim Report
N. K. Smith and W. D. Good Jun. 1978 19 p refs
(AFOSR ISSA 78-0009)
(AD-A056024; AFOSR-78-1069TR) Avail: NTIS

HC A02/MF A01 CSCL 21/2

The enthalpies of combustion of four liquid ramjet fuels, exo-THDC, RJ-4, RJ-4-I, and JP-9, were measured by precision oxygen-bomb combustion calorimetry. GRA

N79-11932# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

AN INVESTIGATION OF THE NUMERICAL METHODS OF FINITE DIFFERENCES AND FINITE ELEMENTS FOR DIGITAL COMPUTER SOLUTION OF THE TRANSIENT HEAT CONDUCTION (DIFFUSION) EQUATION USING OPTIMUM IMPLICIT FORMULATIONS M.S. Thesis

Charles R. Martin Mar. 1978 328 p refs

(AD-A056508; AFIT/GNE/PH/78M-6) Avail: NTIS HC A15/MF A01 CSCL 20/13

The transient heat conduction equation, with Dirichlet and Neumann boundary conditions, is solved by the methods of finite-differences and finite-elements, and the numerical solutions are investigated with respect to accuracy and stability. A general six point finite-difference expression is used for which there exists a high order accurate modification. The finite-element method used is based on a stationary variational principle. Several methods for treating accuracy and convergence problems which result from a discontinuity in the initial condition are investigated. The Crank-Nicolson method is a special case of both the finite-difference and finite-element methods. The finite-difference version of the Crank-Nicolson method is shown to be more accurate than the finite-element version, especially when a discontinuity exists between the initial condition and the boundary conditions. The high order accurate schemes for both finite-differences and finite-elements are shown to be equivalent for the case of linear elements. Some of the results suggest the possibility of finding a finite-element scheme which is highly accurate in a mean square sensr over the entire solution domain.

Author (GRA)

N79-11933# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.

THERMODYNAMICS OF SURFACE CLUSTERS: DIRECT OBSERVATION OF Re_2 ON W(211)

Kaj Stolt, John D. Wrigley, and Gert Ehrlich Feb. 1978 50 p refs

(Contract DAAB07-72-C-0259; Grant NSF DMR-72-02937)

(AD-A057561; R-810; UILU-ENG-78-2203) Avail: NTIS HC A03/MF A01 CSCL 07/2

Direct observations in the field ion microscope make it possible to determine the ratio of bound to dissociated dimers at equilibrium on a crystal surface. In principle, the thermodynamics of dissociation are accessible from the temperature dependence of this ratio. To establish the feasibility of such measurements, the kinetics governing changes in the dimer probabilities are worked out. This is done for isothermal processes, and for conditions typical of the quench from the temperature at which the equilibrium distribution is established to the temperature at which observations are made in the field ion microscope. GRA

N79-11934*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

CRITICAL COMMENTS ON THE CONSTANCY OF THE SPEED OF LIGHT

J. P. Hsu (Texas Univ., Austin) and T. N. Sherry (Texas Univ., Austin) 1977 13 p

(Contract EY-76-S-05-3992)

(ORO-3992-322; NASA-TM-79880) Avail: NTIS HC A02/MF A01

Criticisms on the theory of the constancy of the speed of light are answered. It is shown that the new theory is not logically inconsistent for the reasons expressed. DOE

N79-11935*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

SPEED OF LIGHT AS MEASURED BY TWO TERRESTRIAL STABLE CLOCKS

J. P. Hsu, T. N. Sherry (Texas Univ., Austin), and C. B. Chiu (Texas Univ., Austin) 1977 14 p refs

(Contract EY-76-S-05-3992)

(NASA-TM-79882; ORO-3992-321) Avail: NTIS HC A02/MF A01 CSCL 20J

Despite the recent criticism within the special theory of relativity, there exists an arrangement of stable clocks rotating with the earth which predicts diurnal variations of the one-way speed of light, as suggested previously. DOE

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

No abstracts in this category.

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N79-11936# Decisions and Designs, Inc., McLean, Va.

RESEARCH PROJECT ON DECISION-ANALYTIC TECHNOLOGY Final Report

Rex V. Brown May 1978 35 p refs

(Contract N00014-75-C-0426)

(AD-A056252; PR-78-11-25) Avail: NTIS HC A03/MF A01 CSCL 05/10

This report describes a research effort extending over two and a half years. Its primary objective was to develop the technology in which decisions and inferences are made by individuals and implemented on a computer. The conceptual framework within which the decision aids are developed is personalist decision theory including Bayesian Inference. Tasks were undertaken in five general areas: method generalization; development of specific techniques; development of basic theory; behavioral research; and illustrative case studies. They resulted in 18 technical reports, 10 working papers, and 7 archival publications. Titles and abstracts of working papers are given in the appendix. GRA

N79-11937# Rice Univ., Houston, Tex. Dept. of Electrical Engineering.

COMPUTATIONALLY EFFICIENT ESTIMATORS FOR THE BAYES RISK

Lynn D. Wilcox and Rui J. P. Figueiredo May 1978 114 p refs

(Grant AF-AFOSR-2777-75)

(AD-A055997; EE-TR-7804) Avail: NTIS HC A06/MF A01 CSCL 05/8

A computationally efficient estimator for the Bayes risk is one which achieves a desired accuracy with a minimum of computation. In many problems, for example speech recognition, point evaluations of the class conditional densities are computationally costly. Density evaluations are the single most important factor contributing to the computational effort in Bayes risk estimation, thus the amount of computation required by a Bayes risk estimator is defined as the average number of conditional density evaluations it performs. The accuracy of risk estimator is defined by its variance. In practice, the true optimal estimator cannot be determined since this would in effect require knowledge of the true risk R. Thus a technique whereby the first n of the total N samples are used to approximate the optimal estimator is proposed. The n samples should contain enough information on the closeness of the classes to determine an almost optimal estimator. The last N-n samples are used in the approximate optimal estimator to obtain an accurate estimate of the risk with a minimum of computation. GRA

N79-11938# Iowa Univ., Iowa City. Testing Programs.

A NOTE RELATING TWO DECISION SYSTEMS Technical Report, Oct. 1977 - May 1978

Charles Lewis (Illinois Univ. at Urbana-Champaign) and Melvin R. Novick 1 Jun. 1978 19 p refs

(Contract N00014-77-C-0428; RR0420401)

(AD-A057698; TR-78-2) Avail: NTIS HC A02/MF A01 CSCL 12/1

Specifically, problability, utility, and the expression of preference in terms of conditional expected utility were all developed from a set of non-numerical axioms about preference ordering. It is the purpose of this note to investigate the connections among several systems. GRA

N79-11939# California Univ., Livermore. Lawrence Livermore Lab.
FILE MANAGEMENT SYSTEM
H. H. Loomis, Jr. 29 Jun. 1978 46 p refs
(Contract W-7405-eng-48)
(UCID-17841) Avail: NTIS HC A03/MF A01

A file management system is proposed which will operate within the existing LLL Octopus system, and yet give many desired file handling characteristics. The basic philosophy of the system is to use storage of multiple copies of a given file as the means for increasing the likelihood of successful recovery of a given file. Furthermore, the use of different type file storage devices to store the copies will improve accessibility by permitting access to at least one copy of the file even in the event of failure of any single type of storage device. Storage characteristics, the details of the proposed file management system, a discussion of the system from the user's point of view, and implementation costs and some implementation alternatives are given. DOE

N79-11940# Swedish Board for Space Activities, Solna.
SWEDISH SPACE ACTIVITIES DURING 1977
25 Jan. 1978 9 p
Avail: NTIS HC A02/MF A01

National and international space activities in Sweden are summarized. Projects described include remote sensing of earth resources; meteorology; communications; satellites; sounding rockets; balloons and aeroplanes; and telemetry. ESA

N79-11941# European Space Agency, Paris (France).
[ACTIVITIES OF THE EUROPEAN SPACE AGENCY] Annual Report, 1977
1978 221 p refs
Avail: NTIS HC A10/MF A01

The European Space Agency's scientific and communication satellite, earth observation, Spacelab, and Ariane launcher program activities in 1977 are reviewed. Future programs, technological and scientific research, satellite operations and data processing, and the Space Documentation Service are discussed. ESA facilities, notably ground facilities for space systems and technical facilities, are reported and the organization and structure, external relations, and finance of ESA are dealt with. In 1977 the GEOS, OTS, ISEE-B, and Meteosat satellites were launched. The GEOS and OTS launched failed because of problems with the Thor Delta launchers. ESA

N79-11942# Swedish Space Corp., Solna.
SOUNDING ROCKET ACTIVITY IN EUROPE IN THE 1980'S Final Report
Paris ESA 4 Apr. 1978 65 p refs
(Contract ESA-3330/77-F-HGE(SC))
(S3-3; ESA-CR(P)-1090) Avail: NTIS HC A04/MF A01

A coordinated European sounding rocket effort and its implementation in the next decade is proposed on the basis of an analysis of the present state of sounding rocket activity. A survey of present and planned activity in Europe was carried out. The future use of sounding rockets and its relation to the Shuttle and Spacelab was analyzed. It is concluded that scientific, operational, and economical reasons speak for continued sounding rocket activity in the 1980's and that the output would benefit largely from coordination with the Spacelab Utilization Programme of ESA. The modalities of such a coordinated effort are outlined. Author (ESA)

N79-11943# General Accounting Office, Washington, D. C. Community and Economic Development Div.
NEED FOR IMPROVING MANAGEMENT OF US OCEANOGRAPHIC ASSETS
16 Jun. 1978 33 p refs
(PB-283105/5; CED-78-125) Avail: NTIS HC A03/MF A01 CSCL 05A

GAO reviewed the Nation's ocean research/survey fleet and compiled information on its cost and operations. The United States has no comprehensive national ocean program or plan. Federal oceanic activities are conducted by 21 organizations in 6 departments and 5 agencies. As a result, oceanographic vessels operated to support these activities are funded, operated, and managed independently of one another. No single agency is responsible for the overall coordination or management of the fleet or its operations. GRA

N79-11944# National Technical Information Service, Springfield, Va.
INVENTORY CONTROL, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1970 - 1976
Edith Kenton Aug. 1978 293 p
(NTIS/PS-78/0914/8) Avail: NTIS HC $28.00/MF $28.00 CSCL 05A

Research on theoretical and practical inventory problems in military and commercial activities is cited. Studies are included on automated inventory systems, mathematical programming to forecast replacement and reorder times, and mathematical modeling of multiechelon inventory systems. This updated bibliography contains 287 abstracts, none of which are new entries to the previous edition. GRA

N79-11945# National Technical Information Service, Springfield, Va.
INVENTORY CONTROL, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1977 - Aug. 1978
Edith Kenton Aug. 1978 107 p Supersedes NTIS/PS-77/0778; NTIS/PS-76/0716; NTIS/PS-75/631; NTIS/PS-74/121 (NTIS/PS-78/0915/5; NTIS/PS-77/0778; NTIS/PS-76/0716; NTIS/PS-75/631; NTIS/PS-74/121) Avail: NTIS HC $28.00/MF $28.00 CSCL 05A

Research on theoretical and practical inventory problems in military and commercial activities is cited. Studies are included on automated inventory systems, mathematical programming to forecast replacement and reorder times, and mathematical modeling of multiechelon inventory systems. This updated bibliography contains 102 abstracts, 65 of which are new entries to the previous edition. GRA

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N79-11946*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FISCAL YEAR 1977 SCIENTIFIC AND TECHNICAL REPORTS, ARTICLES, PAPERS, AND PRESENTATIONS
O. L. White, comp. Oct. 1977 80 p refs
(NASA-TM-78138) Avail: NTIS HC A05/MF A01 CSCL 05B

This bibliography lists 78 NASA technical memoranda, notes, papers, and reports presented by Marshall Space Flight Center personnel in FY 1977. In addition, 525 papers by contractors to that facility are cited along with 129 papers cleared for presentation. A.R.H.

N79-11947# Defense Documentation Center, Alexandria, Va.
DDC CATALOGING GUIDELINES Information Processing Report
Barbara P. Gladd Aug. 1978 82 p refs
(AD-A057700; DDC/TR-78/3) Avail: NTIS HC A05/MF A01 CSCL 05/2

Defense Documentation Center (DDC) rules for cataloging of reports for computer entry are arranged in numeric order by the number designations of the computer fields described. Additional data regarding space limitations for each field are provided. These rules are an adaptation of Guidelines for Descriptive Cataloging of Reports, A Revision of COSATI Standard for Descriptive Cataloging of Government Scientific and Technical Reports, published in March 1978 as

AD-A050900. Subject fields and groups, abstracts, posting terms and candidate posting terms are discussed briefly. Included is an appendix from COSATI of personal author surnames with separately written prefixes, as well as several appendices designed for use by trainee catalogers. Author (GRA)

N79-11948# California Univ., Berkeley. Lawrence Berkeley Lab.
AUTOMATIC DATABASE MAPPING AND TRANSLATION METHODS
D. F. Cahn and J. J. Herr Apr. 1978 13 p refs Presented at 4th Conf. of Cybernetics and Systems, Amsterdam, Netherlands, 21 Aug. 1978
(LBL-6782; Conf-780815-1) Avail: NTIS HC A02/MF A01

Automatic methods for content-directed translation and information mapping among machine-readable databases are considered. Multicategory decision algorithms, tested against the classification decisions of human experts in a bibliographic document classification task, matched human performance to the 88 percent level and showed several key parametric sensitivities. The algorithms tested were based on prior state (experiential) descriptor and category usage, and can be configured to provide incremental adaptation or learning. Techniques used emanate from the pattern recognition and artificial intelligence fields. DOE

N79-11949# Sandia Labs., Albuquerque, N. Mex.
COMPUTER BASED MECHANICAL PROPERTY DATA STORAGE AND RETRIEVAL SYSTEM SUITABLE FOR FINITE-ELEMENT ELASTIC-PLASTIC STRUCTURAL ANALYSIS
H. J. Rack and R. Babb May 1978 68 p
(Contract EY-76-C-04-0789)
(SAND-77-1930) Avail: NTIS HC A04/MF A01

A computer based mechanical property data storage and retrieval system suitable for use with advanced finite-element, elastic-plastic structural analysis codes is described. This system is based upon a linkage between the Hewlett-Packard HP-9830 calculator and the CDC-6600 Network Operating System. It is capable of accepting various data input forms and cataloging them for future reference. Subsequent search routines are allowed with specific data sets to be retrieved, the retrieval being accomplished on the basis of individually selected key materials related descriptors, e.g., heat treatment, test temperature, etc. DOE

N79-11950# Oak Ridge National Lab., Tenn.
INDEXGEN: INDEX TERM GENERATION HEURISTICS. SOFTWARE DOCUMENTATION
N. S. Malthouse Jun. 1978 106 p refs
(Contract W-7405-eng-26)
(ORNL/EIS-104) Avail: NTIS HC A06/MF A01

Additional capabilities that employ some of the latest research techniques for automated index term generation for bibliographic files were designed and implemented for the ORCHIS system. These techniques include the use of the term discrimination model for evaluation of potential index terms and the use of low and high document frequency groupings of terms for suggested thesaurus and phrase terms. The theory, design, and implementation of those capabilities are discussed. DOE

N79-11951# Sandia Labs., Albuquerque, N. Mex.
MATERIALS INFORMATION DATA BANK
K. E. Mead Mar. 1978 35 p
(Contract EY-76-C-04-0789)
(SAND-77-0735-Suppl-A) Avail: NTIS HC A03/MF A01

To assist in materials selection, a computerized materials data bank was established. In addition to references on personnel and documents, this data bank provides annotated information on materials so that the designer and materials engineer can draw on it for guidance in selecting materials. The primary purpose of the data bank is to provide materials compatibility data. However, the structure of the system permits the data bank to be used for storage and retrieval of general materials information. G.Y.

N79-11952# Department of Energy, Oak Ridge, Tenn. Technical Information Center.
ENERGY INFORMATION DATA BASE: SUBJECT CATEGORIES
May 1978 82 p refs
(TID-4584-R3) Avail: NTIS HC A05/MF A01

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. These numbers are used in the preparation of printed documents, such as bibliographies and abstract journals, and as searching aids in the online system, RECON. The meaning attached to each of these numbers is explained in this document. It was prepared for use by those indivduals responsible for the assignment of category numbers to documents being entered into the TIC system, those individuals and organizations processing magnetic tape copies of the files, and others who, having no access to RECON, have need for printed copy. DOE

N79-11953# National Bureau of Standards, Washington, D. C.
DIMENSIONS/NBS, VOLUME 62, NUMBER 6 Monthly Report, Jun. 1978
Jun. 1978 32 p refs
(PB-283576/7; NBS-DIM-62/6) Avail: NTIS HC A03/MF A01 CSCL 05B

The major technical developments, highlights of work in progress, major speeches and statements by Bureau management, and a listing of NBS publications are reported. The table of contents for the current issue is: Reorganization - A new look for NBS, M. Jacobs; The economic effects of corrosion, M. Baum; Metric vs. customary - Which is more accurate, J. Odom; NBS, ASM, join to improve phase alloy information, M. Baum; NBS investigates graphite as future standard reference material, K. Higgins; The NBS computer network measurement system, S. Raddack; Advances in understanding of laser spectra of symmetric molecules, D. Orr; New NBS standards aid measurement system; New thermal expansion SRM available; Conference; Publications; New briefs. GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

No abstracts in this category.

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

N79-11954# National Commission on New Technological Uses of Copyrighted Works, Washington, D. C.
TRANSCRIPT OF NATIONAL COMMISSION ON NEW TECHNOLOGICAL USES OF COPYRIGHTED WORKS
10 Jul. 1978 42 p The Final Meeting held at Washington, D. C., 10 July, 1978
(PB-284178/1; CONTU-78-0007) Avail: NTIS HC A03/MF A01 CSCL 05B

A transcript of the final meeting of the Commision held in Washington, D.C. on July 10, 1978 is reported. At the meeting the Commisioners present discussed the commision's final report with its concurring and dissenting opinions and voted unanimously to submit the report to the President and the Congress and to have it printed for public distribution. GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

N79-11955*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FUEL CELL ON-SITE INTEGRATED ENERGY SYSTEM PARAMETRIC ANALYSIS OF A RESIDENTIAL COMPLEX

Stephen N. Simons [1977] 25 p refs Presented at the Fuel Cell Workshop, Sarasota, Fla., 14-17 Nov. 1977; sponsored by DOE

(NASA-TM-78996; E-9780) Avail: NTIS HC A02/MF A01 CSCL 10B

A parametric energy-use analysis was performed for a large apartment complex served by a fuel cell on-site integrated energy system (OS/IES). The variables parameterized include operating characteristics for four phosphoric acid fuel cells, eight OS/IES energy recovery systems, and four climatic locations. The annual fuel consumption for selected parametric combinations are presented and a breakeven economic analysis is presented for one parametric combination. The results show fuel cell electrical efficiency and system component choice have the greatest effect on annual fuel consumption; fuel cell thermal efficiency and geographic location have less of an effect. Author

N79-11956# Department of Energy, Washington, D. C. Div. of Transportation Energy Conservation.

ELECTRIC AND HYBRID VEHICLE PROGRAM Quarterly Report

May 1978 21 p refs

(DOE/CS-0026/2-Vol-2-No-2) Avail: NTIS HC A02/MF A01

Public Law 94-413 was amended on February 25, by Public Law 95-238 to give more flexibility to the EHV Demonstration Program and to strengthen the Loan Guaranty provisions. Proposed performance standards for EHVs were printed in the Federal Register on February 10, and, final standards were prepared. Forty-nine proposals were received from potential participants in the EHV Demonstration Project as fleet operators and marketing/servicing representatives. Final regulations covering the Loan Guaranty Program were signed by the Department of Energy (DOE). Increased emphasis is being placed on development of improved batteries. Programs are continuing in assessing state-of-the-art technology, in vehicle testing, and in the development of improved EHV components. These, and other developments in the EHV Program, are discussed. DOE

N79-11957# Georgia Inst. of Tech., Atlanta. Environmental Resources Center.

TRANSFER OF SYSTEMS TECHNOLOGY TO URBAN WATER MANAGEMENT Completion Report, Sep. 1975 - Mar. 1978

Augustine O. Esogbue and Gene Willeke Apr. 1978 235 p refs

(Contract DI-14-34-0001-6069)

(PB-283466/1; ERC-04-78; W78-08952; OWRT-B-116-GA(1)) Avail: NTIS HC A11/MF A01 CSCL 13B

Government agencies have funded research studies employing the techniques of operations research and systems analysis in the analysis, planning, and management of water resources systems. Very few of these models have been implemented or employed. The objective of this study was to initiate the closure mechanism between research, implementation and further research. Out of over 1000 papers reviewed in the literature from 1965-1976, 125 papers were subjected to an extensive evaluation. The evaluations were synthesized and presented in a manner that could be understood by both users and developers of the various models. GRA

N79-11958# National Technical Information Service, Springfield, Va.

SOLID WASTE DISPOSAL ECONOMICS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Final Report, 1977 - Aug. 1978

Diane M. Cavagnaro Aug. 1978 140 p Supersedes NTIS/PS-77/0790; NTIS/PS-76/0661; NTIS/PS-75/536; NTIS/PS-74/092

(NTIS/PS-78/0895/9; NTIS/PS-77/0790; NTIS/PS-76/066; NTIS/PS-75/536; NTIS/PS-74/092) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

The topics cited in the bibliography include various aspects of the economics of solid waste disposal and abatement, covering studies concerning industries, transportation, urban planning, and recycling. Topics such as profitability of waste recovery, the economics of using new solid waste processing and disposal techniques, and their impact on handling costs are included. This updated bibliography contains 134 abstracts, 86 of which are new entries to the previous edition. GRA

N79-11959# National Technical Information Service, Springfield, Va.

SOLID WASTE DISPOSAL ECONOMICS, VOLUME 1. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1964 - 1976

Diane M. Cavagnaro Aug. 1978 185 p

(NTIS/PS-78/0894/2) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

This bibliography includes the economics of solid waste disposal and abatement. The citations cover studies concerning industries, transportation, urban planning, and recycling. They include topics such as profitability of waste recovery, the economics of using new solid waste processing and disposal techniques, and their impact on handling costs. This updated bibliography contains 179 abstracts, none of which are new entries to the previous edition. GRA

N79-11960# National Technical Information Service, Springfield, Va.

WATER POLLUTION ECONOMICS, VOLUME 3. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, Sep. 1977 - Aug. 1978

Diane M. Cavagnaro Sep. 1978 133 p Supersedes NTIS/PS-77/0784; NTIS/PS-76/0666; NTIS/PS-75/537; NTIS/PS-74/094

(NTIS/PS-78/0927/0; NTIS/PS-77/0784; NTIS/PS-76/0666; NTIS/PS-75/537; NTIS/PS-74/094) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

This bibliography cites aspects of the economics of water pollution control and management. The citations cover the economics involved with industrial clean up, government planning, resource management, and urban planning. Economic impacts of pollution and its control on specific industries, regions, or the economy as a whole are included. This updated bibliography contains 126 abstracts, all of which are new entries to the previous edition. GRA

N79-11961# National Technical Information Service, Springfield, Va.

WATER POLLUTION ECONOMICS, VOLUME 2. A BIBLIOGRAPHY WITH ABSTRACTS Progress Report, 1975 - Aug. 1977

Diane M. Cavagnaro Sep. 1978 190 p

(NTIS/PS-78/0926/2) Avail: NTIS HC $28.00/MF $28.00 CSCL 13B

The economics of water pollution control and management, covering the economics involved with industrial clean up, government planning, resource management, and urban planning are reported. The economic impacts of pollution and its control on specific industries, regions, or the economy as a whole are included. This updated bibliography contains 183 abstracts, none of which are new entries to the previous edition. GRA

N79-11962# Delmarva Advisory Council, Salisbury, Md.

TECHNOLOGY ACQUISITION UNIT: SUMMARY OF COMPLETED PROJECT Final Technical Report, 1 Jul. 1976 - 31 Dec. 1977

28 Mar. 1978 58 p refs

(Grant NSF ISP-76-09362)

(PB-283995/9; NSF/RA-780151) Avail: NTIS HC A04/MF A01 CSCL 05A

This program was designed: (1) to provide a technology transfer network and management structure to serve the needs of regional and local authorities for technical knowledge and resource application; (2) to explore and work toward business expansion and specifically job creation through adaption of newly developed technologies within the business community; and (3) to develop a model program and/or management structure applicable to other rural regions in the country. GRA

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N79-11963 California Univ., San Diego.
AN ANALYSIS OF INFRARED SPECTRA OF SOME GASEOUS NEBULAE, WITH EMPHASIS ON THE PLANETARY NEBULA NGC 7027 Ph.D. Thesis
Ray William Russell 1978 181 p
Avail: Univ. Microfilms Order No. 7819096

Infrared spectra from 2 to 13 microns (with resolution delta lambda/lambda approximately 0.015-0.02) of a variety of objects (including the planetary nebulae NGC 7027, BD + 30deg3639, and IC 418: the galaxy M82; and CRL 915/HD 44179) are discussed. The inclusion of 4 to 8 micron spectrophotometry obtained from the Kuiper Airborne Observatory is stressed, although the entire 2 to 13 microns region is shown to be very useful in understanding the physical conditions and radiation mechanisms in these and other sources. A collisionally excited forbidden-line analysis is summarized and the equations and parameters developed to permit the identification of such lines in the astronomical data and their subsequent use in ion abundance calculations are presented. Emissivity measurements on collections of small (2-5 micron), isolated particles are included for a number of materials. Dissert. Abstr.

N79-11964 Yale Univ., New Haven, Conn.
A DYNAMICAL STUDY OF COMPACT GROUPS OF GALAXIES Ph.D. Thesis
James Anthony Rose 1977 129 p
Avail: Univ. Microfilms Order No. 7818094

N-body computer simulations of loose groups of galaxies show that the compact subsystems that occasionally form are usually transient unbound systems of galaxies near group perigalacticon which are almost as compact as they appear to be on the sky. A 9% overestimate of the mass of the group occurs on the average if the compact groups are assumed to be in virial equilibrium with the galaxy separation and velocity vectors randomly oriented with respect to the plane of the sky. A slightly modified form of the virial theorem, accounting for this 9% mass overestimate, was applied to two compact groups of galaxies for which accurate velocity and magnitude data were obtained. The mass-to-light ratios of these two groups are 4 and 24, indicating that galaxies do not possess massive halos. Dissert. Abstr.

N79-11965 Cornell Univ., Ithaca, N. Y.
A STUDY OF BINARY GALAXIES: TOTAL MASS AND THE RATIO OF MASS-TO-LUMINOSITY Ph.D. Thesis
Steven Douglas Peterson 1978 157 p
Avail: Univ. Microfilms Order No. 7817803

The functional dependence of mass on spatial separation in binary galaxies was investigated. A statistical method was developed to estimate an average galaxian mass based on the orbital parameters for a given sample of binary galaxies. Angular separation and radial velocity information are combined to produce a mass estimator for each binary system based on a point mass-circular orbit model. The masses of individual spiral galaxies are approximately 3 to 4 times greater than those estimated from internal rotation based on the 21 cm profile width and traditional rotation curve models. While the existence of extended halos is refuted, the observational evidence is insufficient to further distinguish among the various mass distributions; however, neither an enhanced disk component nor a small stabilizing halo is excluded by the data. Dissert. Abstr.

N79-11966 Texas Univ. at Austin.
A STUDY OF ACCRETION DISCS IN DWARF NOVAE Ph.D. Thesis
Alan Lee Kiplinger 1978 201 p
Avail: Univ. Microfilms Order No. 7817660

The observations include rather extensive coverage of eruptions of two dwarf novae, SS Cygni at minimum light, and Z Cam at standstill. Also included are the radial velocity mass redeterminations of two dwarf novae. A spectral desynthesis routine was developed which is used to decompose the observed energy distribution of SS Cygni at minimum light into various components. This technique provides an absolute flux calibration of the system which is used to calibrate absolute physical parameters of the erupting disc. The results of the spectra desynthesis also demonstrate that the steady-state accretion disc of SS Cygni at maximum light becomes time dependent during the decline to minimum. Furthermore, the physical character of the accretion disc at minimum light, if indeed an accretion disc is present, radically differs from the maximum light configuration. Dissert. Abstr.

N79-11967 Texas Univ., Austin.
A SURVEY OF HIGH RESOLUTION TWO MICRON INFRARED SPECTRA OF MIRA VARIABLES Ph.D. Thesis
Kenneth Harry Hinkle 1978 233 p
Avail: Univ. Microfilms Order No. 7817650

A group of sixteen high resolution spectra were obtained of the 4000-6700 cm superscript-1 region of four typical Mira variables. Eleven spectra are of R Leonis providing coverage throughout the light cycle of one typical Mira. A survey was conducted of these spectra to determine what molecules and elements contribute the more prominent spectral features. The velocities and strengths of the lines were then interpreted in terms of atmospheric structure and chemical composition. All four stars are oxygen rich and the dominant molecular spectral features are the CO first and second overtone bands, the OH first overtone band and the various bands of H2O. A variety of neutral atomic lines are present. The strongest atomic lines are the low excitation lines of scandium and titanium. Dissert. Abstr.

N79-11968*# California Inst. of Tech., Pasadena.
A SEARCH FOR X-RAY PULSATIONS FROM THE GALACTIC CENTER Final Report
France A. Cordova, Gordon P. Garmire, and Walter H. G. Lewin (MIT, Cambridge) Nov. 1978 13 p refs
(Grant NsG-5197)
(NASA-CR-157930) Avail: NTIS HC A02/MF A01 CSCL 03A

Data from the SAS-3 satellite were used in a search for X-ray pulsations from the direction of the galactic center. No periodic X-ray behavior was detected in the frequency interval 0.6 Hz to 0.0006 Hz and energy range 2.5 - 35 keV. For periods less than 60 sec, the upper limit to the amplitude of any pulsation in the 2.5 - 10 keV band is approximately .0017 cts/sq cm/s. This corresponds to a pulsed fraction of approximately 1.3 percent of the total GCX flux. Somewhat higher limits apply for longer periods and for energies greater than 10 keV. A.R.H.

N79-11969# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
RECENT MEASUREMENTS WITH A BALLOON BORNE Ge (Li) SPECTROMETER IN GAMMA-RAY ASTRONOMY
Jose Marques daCosta, D. Boclet (Centre d'Etudes Nucl. de Saclay, France), J. Claisse (Centre d'Etudes Nucl. de Saclay, France), Ph. Durouchoux (Centre d'Etudes Nucl. de Saclay, France), P. Pagnier (Centre d'Etudes Nucl. de Saclay, France), R. Rocchia (Centre d'Etudes Nucl. de Saclay, France), F. Albernhe (Centre

d'Etudes Spatiales des Rayonnements, Toulouse), M. Frabel (Centre d'Etudes Spatiales des Rayonnements, Toulouse), G. Vedrenne (Centre d'Etudes Spatiales des Rayonnements, Toulouse), and E. Olivier (Centre d'Etudes Nucl. de Saclay, France) Dec. 1977 27 p refs
(INPE-1170-PE/107) Avail: NTIS HC A03/MF A01

A high resolution gamma ray spectrometer for stellar measurements was developed. The instrument consists of a large Ge(Li) crystal (140 cu cm) cooled at liquid nitrogen temperature and actively shielded by a sodium iodide crystal. Spectral resolution and effective area are respectively 3.0 KeV (F.W.H.M.) and 2.7 sq cm at 1 MeV. Three successful flights were carried on board a stabilized gondola. The background total counting rate was about 10 counts/s in the 0.1-8 MeV energy range at floating altitude (2.8g/sq cm residual atmosphere, 12 GV cut off-rigidity). The sensitivity of the detector is about 10 to the minus three power/sq cm/s over the energy range for three hours of observation of a point source. Preliminary results and future developments are described. A.R.H.

N79-11970# IIT Research Inst., Annapolis, Md.
POTENTIAL INTERFERENCE TO 6 CM CONUS RADIO ASTRONOMY OBSERVATORIES FROM MLS C-BAND Final Report
R. P. Rocca, Jr. Jun. 1978 71 p
(Contracts F19628-78-C-0006; DOT-FA70WAI-175)
(AD-A057368; ECAC-PR-76-002; FAA-RD-77-111) Avail: NTIS HC A04/MF A01 CSCL 03/2

An analysis was performed to determine the potential for interference to radio astronomy observatories operating in the band 4.99-5.00 GHz from the C-band DME (air-to-ground) associated with the Time Reference Scanning Beam Microwave Landing System, as a function of proposed MLS DME frequency assignment plans. Author (GRA)

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N79-11971 Temple Univ., Philadelphia, Pa.
A MODEL OF THE UPPER PHOTOSPHERE THROUGH INVERSION OF A SOLAR INTENSITY DISTRIBUTION Ph.D. Thesis
Joseph Louis Sowers 1978 194 p
Avail: Univ. Microfilms Order No. 7817349

One of the major difficulties in the analysis of limb darkening observations is in the determination of the source function. The source function, which is the ratio of the emission coefficient to the absorption coefficient, is, even in its simplest form, described by a Fredholm integral equation of the first kind. Attempts to solve or circumvent the equation are discussed and a method for approximating the solution of the integral equation was developed. The general method was applied to the specific problem of solar limb darkening. Numerical experiments were used to compare the technique to previous attempts and to analysis of errors, regions of application, and the influence of various parameters are discussed. Dissert. Abstr.

N79-11972 Florida Univ., Gainesville.
MASS AND MOMENTUM EXCHANGE IN CLOSE BINARY SYSTEMS Ph.D. Thesis
James Bruce Rafert 1978 795 p
Avail: Univ. Microfilms Order No. 7817454

All available times of primary and secondary minima for these systems were assembled and subjected to least squares analysis. Linear, parabolic, cubic and periodic/parabolic representations were computed for each system. The most reasonable representation of the period variation for each system was combined with other systemic parameters to yield conservative case values of the period change with time dP/dt, and of the mass flow rate dm/dt. Nonconservative effects were investigated by a particle trajectory model in which material conforming to a Maxwellian velocity distribution was allowed to leave the vicinity of the inner Lagrangian Point L sub 1 for a wide range of systemic parameters. Subject to these nonconservation assumptions, new values of the period change (dP/dt) sub NCJ and the mass flow rate (dm/dt) sub NCJ were calculated. Dissert. Abstr.

N79-11973 Princeton Univ., N. J.
NONLINEAR THERMAL CONVECTION IN BOUSSINESQ FLUIDS AND IDEAL GASES WITH PLANE-PARALLEL AND SPHERICAL GEOMETRIES Ph.D. Thesis
Philip Stephen Marcus 1978 367 p
Avail: Univ. Microfilms Order No. 7819244

Three-dimensional, stable solutions of thermally convecting Boussinesq fluids and ideal gases in plane-parallel and spherical geometries are found by rederiving the Boussinesq equations and deriving corrected versions of Gough's anelastic equations for a self-gravitating, ideal gas. A Galerkin expansion (which is exact for the mean-field equations) is used where the horizontal dependence of the velocity and thermodynamic functions are expanded in a set of approximately 100 basis functions. In a self-gravitating spherical, convecting fluid, specialized closed sets of planforms are found that correspond to the five regular solids. A single, dodecahedral mode is used to solve a model of a convecting red-giant star. The results are compared with the mixing-length theory. No one value of the mixing-length can produce the correct convective flux and velocity throughout the entire star. Dissert. Abstr.

N79-11974 Harvard Univ., Cambridge, Mass.
TWO-DIMENSIONAL CALCULATION OF GAS FLOW IN BARRED SPIRAL GALAXIES Ph.D. Thesis
Larry S. Liebovitch 1978 167 p
Avail: Univ. Microfilms Order No. 7819106

A two dimensional, numerical, finite difference, fluid calculation was used to predict the steady state gaseous response to assumed stellar potential. Standing shocks are predicted along the trailing edges of the spiral arms in the outer region and along the leading edges of the bar in the central region. The regions of predicted density maxima extend along the spiral arms and continue as appendages to the spiral arm past the point where the spiral arm bends into the central bar. The predicted velocity fluid field agrees with the limited observations made near the bars and predicts the velocities, as yet unmeasured, away from the bar. The prediction that inside the Inner Lindblad Resonance the gaseous density maximum should lead the stellar potential minimum by 45 deg is confirmed. It is also shown that under certain conditions the gaseous density maximum can lead the stellar potential minimum by 90 deg. Dissert. Abstr.

N79-11975 Harvard Univ., Cambridge, Mass.
SOME STOCHASTIC PROCESSES IN ASTROPHYSICS Ph.D. Thesis
Edgar Knobloch 1978 193 p
Avail: Univ. Microfilms Order No. 7819104

A general equation characterizing multiplicative stochastic processes is considered, and two formal perturbation procedures are examined. The mathematical foundation of the dynamo equation is described for the solar dynamo theory. An exact Eulerian description of the diffusion of passive scalar and vector fields by turbulence is given. Renormalized transport coefficients are introduced, and the possibility that the renormalized diffusivity of the mean magnetic field is negative is investigated. The homologous evolution of galaxies is discussed as well as the evolution of the stellar distribution function using the Fokker-Planck equation. The method offers a theoretical framework for the study of mass loss and the dynamical evolution of tidally interacting galaxies, and thus offers a useful alternative to numerical simulations. Dissert. Abstr.

N79-11976 Harvard Univ., Cambridge, Mass.
THE POPULATION 2 MAIN SEQUENCE Ph.D. Thesis
Bruce William Carney 1978 308 p
Avail: Univ. Microfilms Order No. 7819107

UBVRIJHK photometry, 50 A-bandpass scanner spectrophotometry of selected points in the Paschen continuum, echelle spectroscopy, and a grid of model stellar atmospheres for metal-deficient dwarfs are presented and discussed. The globular cluster NGC 6752 is studied with photoelectric and photographic UBV photometry. The metallicity is estimated using the delta (U-B) sub 0.6 values for main sequence stars and DDO photometry

and image-tube spectroscopy of red giant stars. Main sequence fitting to the theoretical isochrones yield a distance moduli, while main sequence turn-off fitting yield cluster age. A correlation between cluster and metallicity may also be presented, with the metal-poor cluster being oldest and only a gradual heavy element enrichment indicated. Dissert. Abstr.

N79-11977 California Inst. of Tech., Pasadena.
OBSERVATIONS OF INTERSTELLAR MOLECULAR HYDROGEN EMISSION Ph.D. Thesis
Steven Van Walter Beckwith 1978 116 p
Avail: Univ. Microfilms Order No. 7818196

A research for interstellar molecular hydrogen emission, as seen in the v = 1 yields 0 S(1) line, is presented. Thirty-six objects were observed as part of this research: seven objects show emission from vibrationally excited H2. Of the seven new sources, six are associated with planetary nebulae and one is associated with T Tauri. The new sources provide a basis for further study of interstellar H2 emission, planetary nebulae, and T Tauri stars. An in-depth study of the molecular hydrogen emission from the Orion nebulae is also presented. Measurements of the v = 1 yields 0 Q(3)/S(1) intensity ratio are also given. The measurements of Orion strongly imply that the vibrationally excited molecular hydrogen exists behind the discontinuity of a strong shock wave. Dissert. Abstr.

N79-11978*# Lunar and Planetary Inst., Houston, Tex.
INVITED PAPERS PRESENTED TO A WORKSHOP ON THERMODYNAMICS AND KINETICS OF DUST FORMATION IN THE SPACE MEDIUM
P. C. Robertson 1978 79 p refs Workshop held at Houston, Tex., 6-8 Sep. 1978
(Contract NSR-09-051-001)
(NASA-CR-157824; LPI-Contrib-330) Avail: NTIS HC A05/MF A01 CSCL 03B

Abstracts of 25 papers relating to condensation processes in the early solar system are presented. Special emphasis is given to the transition of an initial vapor phase in the space medium, the characterization of condensation environments, and condensation processes in the space medium. The question of whether some fraction of the solar system solids (particularly exemplified by meteoritic solids) may be interstellar grains that gathered in the region of the proto-sun, rather than being products of local condensation is addressed. A.R.H.

N79-11979*# California Univ., Berkeley. Dept. of Physics.
NH3 IN IRC PLUS 10216
A. L. Betz, R. A. McLaren, and D. L. Spears 1978 16 p refs Prepared in cooperation with Toronto Univ. and Lincoln Lab., MIT
(Grants NGR-05-003-452; NGL-05-003-272)
(NASA-CR-157921) Avail: NTIS HC A02/MF A01 CSCL 03B

Ammonia was detected in the circumstellar envelope of IRC +10216 by means of three infrared absorption lines in the nu sup 2 band around 950/cm. The lines are fully resolved at a resolution of 0.22 km/sec and indicate that most of the circumstellar gas is accelerated to expansion velocities around 14 km/sec within a few stellar radii. The NH3 profiles indicate a rotational temperature between 400 and 700 K, and H2 density between 10 to the 8th power/cu cm and 10 to the 10th power/cu cm, and NH3 column density of 10 to the 17th power/sq cm. The H2 density indicates that the mass of the circumstellar envelope within a 1 arcsec radius is approximately 0.1 solar masses. Author

N79-11980# Aerospace Corp., El Segundo, Calif. Space Sciences Lab.
EFFECTS OF MASS LOSS ON THE EVOLUTION OF MASSIVE STARS: CRITICAL MASS LOSS RATES
D. S. P. Dearborn (Arizona Univ., Tuscon) and J. B. Blake 31 Oct. 1978 26 p refs
(ATR-79(9552)-2) Avail: NTIS HC A03/MF A01

A critical mass-loss rate is discussed which, in the absence of binary mass transfer or extremely high mass-loss rates in the red giant stage, determines whether a star will become a stripped core resembling a Wolf-Rayet star. Stars losing mass at this rate undergo two stages of N-14 enhancement, and result in models resembling first WN and later WC stars. The nucleosynthetic yield of a star undergoing mass loss is effected. The N-14 yield and C/O ratio is increased, and delta He/delta Z is increased from 0.3 to as much as 3.0. Author

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N79-11981 Cornell Univ., Ithaca, N. Y.
OCCULTATION STUDIES OF PLANETS AND SATELLITES Ph.D. Thesis
Edward Willson Dunham 1978 186 p
Avail: Univ. Microfilms Order No. 7817854

Various topics in occultation astronomy are considered, including equipment design and testing, the determination of the normal reflectance of a satellite from lunar occultation observations and a discussion of the observations of the occultation of SAO 158687 by Uranus. The Uranus discussion includes an analysis of the ring system and the structure of the Uranian upper atmosphere. Dissert. Abstr.

N79-11982 Harvard Univ., Cambridge, Mass.
GIANT GASEOUS PROTOPLANETS Ph.D. Thesis
William Michael DeCampli 1978 113 p
Avail: Univ. Microfilms Order No. 7819105

The structure and evolution of giant gaseous protoplanets in the mass range 0.3 to 4.5 Jovian masses are investigated. Under the assumptions of the calculations, the following properties are found: (1) the central region of protoplanets of mass less than about one Jovian mass is, at some evolutionary epoch, thermodynamically favorable to the liquification of major interstellar grain constituents; (2) grains in this region can grow and infall to form a planetary core in ten years; (3) all protoplanets studied are convective throughout most of their interior; (4) thermal contraction time depends sensitively on the surface opacity (T less than 200 K). Dissert. Abstr.

N79-11983 Cornell Univ., Ithaca, N. Y.
THE MORPHOLOGY OF PHOBOS AND DEIMOS Ph.D. Thesis
Peter Chew Thomas 1978 286 p
Avail: Univ. Microfilms Order No. 7817881

Imagery from Mariner 9 and the Viking Orbiter was used to study the surface features of Phobos and Deimos. The high density of the impact craters shows that the surfaces are generally more than one billion years old, and may be three times that age. Most of the debris ejected from impact craters on Phobos is permanently lost from the satellite because of its low gravity and proximity to Mars. Deimos retains more of its cratering debris. Both satellites have large blocks among their retained ejecta. The grooves on Phobos are surface expressions, in a loose regolith, of deeper fractures that were formed or widened by the impact that created the Stickney crater. The grooves diminish in size and number away from Stickney and they are absent in the area opposite that crater. Deimos lacks grooves, perhaps because of a difference in cratering history or in the mechanical properties of the two satellites. Dissert. Abstr.

N79-11984* National Aeronautics and Space Administration, Washington, D. C.
PIONEER VENUS ENCOUNTER WILL OCCUR IN DECEMBER
Nov. 1978 134 p
(NASA-News-Release-78-181; P78-10189) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, B.W.I. Airport, Md. 21240 CSCL 03B

The encounter time line and mission profile are presented for the Pioneer Venus 1 Spacecraft and for the four probes and transponder bus that comprise Pioneer Venus 2. Known facts

about Venus are reviewed and the history of discoveries about the planet is related. Operations of the orbiter and multiprobe are described as well as the 30 instruments being carried and provisions for data transmission. A.R.H.

N79-11985*# Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research.
INFRARED SPECTROSCOPY OF SIMULATED MARTIAN SURFACE MATERIALS Final Report, 1 Sep. 1977 - 30 May 1978
Owen B. Toon and Carl Sagan Sep. 1978 10 p refs
(Grant NsG-2277)
(NASA-CR-157922) Avail: NTIS HC A02/MF A01 CSCL 03B

Mineralogy inferred from the Viking X-ray fluorescence spectrometry (XRFS) is compared with mineralogy indicated by spectral data. The comparison is done by taking laboratory spectra of Viking analog minerals. Both XRFS and infrared data are consistent with clays as the dominant SiO2 containing minerals on Mars. The X-ray fluorescence data might also be consistent with the dominance of certain mafic SiO2 igneous minerals, but the spectral data are probably inconsistent with such materials. Sulfates, inferred by XRFS, are consistent with the spectral data. Inferences following Mariner 9 that high-SiO2 minerals were important on Mars may have been biased by the presence of sulfates. Calcium carbonate, in the quantities indirectly suggested by XRFS are inconsistent with the spectral data, but smaller quantities of CaCO3 are consistent, as are large quantities of other carbonates. A.R.H.

N79-11986*# National Aeronautics and Space Administration, Washington, D. C.
ESTIMATION OF THE DENSITY OF MARTIAN SOIL FROM RADIOPHYSICAL MEASUREMENTS IN THE 3-CENTIMETER RANGE
N. N. Krupenio Sep. 1977 37 p refs Transl. into ENGLISH from "Otsenka Plotnosti Grunta Marsa Po Dannym Radiofizicheskikh Izmereniy v 3-Santimetrovom Diapazone", Rept. Pr-438 Inst. of Space Res., Moscow, 1977 p 1-31 Transl. by Transemantics, Inc., Washington, D. C.
(Contract NASw-2792)
(NASA-TM-75047) Avail: NTIS HC A03/MF A01 CSCL 03B

The density of the Martian soil is evaluated at a depth up to one meter using the results of radar measurement at lambda sub 0 = 3.8 cm and polarized radio astronomical measurement at lambda sub 0 = 3.4 cm conducted onboard the automatic interplanetary stations Mars 3 and Mars 5. The average value of the soil density according to all measurements is rho bar = 1.37 plus or minus 0.33 g/ cu cm. A map of the distribution of the permittivity and soil density is derived, which was drawn up according to radiophysical data in the 3 centimeter range. G.Y.

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N79-11987 Temple Univ., Philadelphia, Pa.
A MEASUREMENT OF THE RADIAL BRIGHTNESS VARIATION AT THE EXTREME SOLAR LIMB Ph.D. Thesis
Warren Arnold Rosen 1978 133 p
Avail: Univ. Microfilms Order No. 7817338

The solar limb darkening function is obtained at 433 nm from measurements made at the total solar eclipse of 7 March 1970 at Virginia Beach, Va. Light from the waning solar crescent was monitored photoelectrically and the photomultiplier output was recorded on magnetic tape. The resulting eclipse curve is analyzed by the method of Julius which is modified in three ways to allow the use of small zones and also to minimize the effects of irregularities in the lunar limb. A criterion is developed for locating the effective zone radii in terms of the irregularities by assuming that the limb darkening function is linear over each zone. Finally, the zone widths are taken successively wider away from the limb in order to minimize the contributions of errors in the outer few zones to the calculations of inner zone intensities. With these modifications the limb darkening function is obtained over the range 0.937 to 0.99988 solar radius. A distinct limb brightening effect is found at R = 0.999 solar radius. This is shown to correspond to a thin hot layer at an optical depth of 0.05. Dissert. Abstr.

N79-11988 Cornell Univ., Ithaca, N. Y.
DYNAMICS OF THE SOLAR CONVECTION ENVELOPE Ph.D. Thesis
Richard Steven Bogart 1978 155 p
Avail: Univ. Microfilms Order No. 7817821

The usual treatment of turbulence convection in stellar envelopes does not provide a dynamic model for the organized motion of several scales which are observed in the Sun. In the absence of a complete theory of turbulent convection, questions occur. One approach is to represent convective motions by the radiatively-damped inviscid linear modes of an unstably stratified fluid. It is possible to establish a structure which is roughly compatible with energy transport by linear modes throughout the envelope. It is also possible to demonstrate that the temperature structure of a convective envelope incorporating meridional circulation of a magnitude necessary to produce the solar differential rotation may be consistent with observations of near uniformity of photospheric temperatures, even in the framework of standard mixing-length theory. Dissert. Abstr.

N79-11989# Naval Ocean Systems Center, San Diego, Calif.
X-RAY FLARE AND SHORT-WAVE FADE DURATION MODEL. OUTAGE TIME IS DIRECTLY RELATED TO SOLAR PEAK OF X-RAY EVENT BY USE OF EVENT RISE CHARACTERISTICS Interim Report, Jan. 1976 - Jan. 1978
P. E. Argo, I. J. Rothmuller, and J. R. Hill 9 May 1978 13 p
(ZF52551001)
(AD-A057284; NOSC/TR-255) Avail: NTIS HC A02/MF A01 CSCL 03/2

A model is developed for predicting, in real time, the time-to-recovery for hf signals during a solar X-ray event. The model is designed to give predictions as early in the event as possible, and is backed by an update scheme to correct inaccurate predictions when such are recognized. The model was made possible by the fact that the recovery period of most solar X-ray events can be characterized by an exponential decay with one of four time constants. The choice of time constant can be made by using observations of the rise portion of the event. Author (GRA)

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N79-11990 Columbia Univ., New York.
X-RAY POLARIZATION MEASUREMENTS OF THE CRAB NEBULA AND PULSAR AND CENTAURUS X-3 AND HERCULES X-1 PULSARS Ph.D. Thesis
Eric Howard Silver 1978 297 p
Avail: Univ. Microfilms Order No. 7819432

The Crab pulsar is known to be linearly polarized at radio and optical wavelengths, and the polarization vector rotates as a function of pulse phase. A similar behavior at X-ray energies would suggest a common emission mechanism. The OSO-8 polarimeters were therefore employed to search for pulse dependent X-ray polarization. There is marginal evidence that the behavior of the X-ray polarization position angles is the same as that at optical frequencies. Three-sigma upper limits to the polarization of 13.5 percent and 19 percent at 2.6 keV and 5.2 keV, respectively, were obtained for Cen X-3 when the data were averaged over the pulse and binary periods. The upper limit for Her X-1 at 2.6 keV is 60 percent. At the 90 percent confidence level, the leading edge of the Cen X-3 pulse profile is 9 percent polarized at a position angle of 94 deg; the wing of the pulse is 29 percent polarized at a position angle of 127 deg. Three sigma upper limits to the polarization at 2.6 and 5.2 keV

are presented for several pulse phase regions of the light curve. Dissert. Abstr.

N79-11991 Rochester Univ., N. Y.
EVOLUTION OF HII REGIONS IN STREAMING GAS FLOW: A THEORETICAL INVESTIGATION Ph.D. Thesis
Stuart John Kerridge 1978 179 p
Avail: Univ. Microfilms Order No. 7818265

Observations of H2 regions show little resemblance to spherically symmetric models. Non-spherical H2 regions can develop as a result of the motion of the star through the gas, nonuniform initial density, presence of magnetic fields and other effects. A two dimensional, axisymmetric, gas dynamic code is developed, with subsidiary one dimensional checks, that can follow the evolution, for diffuse H2 regions, on time scales long compared to the pre-main sequence stage of the exciting star. Results of calculations are presented for a star moving at 10 km/sec through the gas. Dissert. Abstr.

N79-11992 Princeton Univ., N. J.
THE DIPOLE ANISOTROPY OF THE COSMIC MICROWAVE BACKGROUND AT A WAVELENGTH OF 1.6 cm Ph.D. Thesis
Brain Elliot Corey 1978 252 p
Avail: Univ. Microfilms Order No. 7818322

A Dicke-switched radiometer operating at 1.6 centimeters wavelength was built to measure this anisotropy. The radiometer employed two antennas pointing 90 degrees apart. In order to measure the polar component of the anisotropy, the radiometer was flown from a balloon. The entire radiometer was rotated about a vertical axis once per minute so that instrumentation offsets could be distinguished from the real anisotropy signal. Eight hours of data were obtained in a flight on the night of May 10-11, 1975. Corrections were applied to the data for the galactic background and emission by discrete sources. The corrected data are consistent with a dipole anisotropy of peak amplitude 2.9 + or - 0l7 milliKelvin (standard error) in the direction 12.3 superscript h + or - 1.4 superscript h right ascension and - 21 degs + or - 21 degs declination. Dissert. Abstr.

N79-11993*# Leiden Univ. (Netherlands).
MAPS OF JOVIAN RADIO EMISSION AT 1412 MHz Final Technical Report, 15 Jan. - 15 Oct. 1978
Imke de Pater 15 Oct. 1978 28 p refs
(Grant NsG-7264)
(NASA-CR-157920) Avail: NTIS HC A03/MF A01 CSCL 03B

Jupiter was observed with the Westerbork Radio Telescope at a frequency of 1412 MHz in December 1977 when it was at its most northerly opposition to the earth. Pictures were obtained of Jupiter in all four Stokes parameters at 24 different rotational aspects of the planet, each integrated over 15 degrees of Jovian rotation. The maps clearly indicate the presence of higher order terms in the dipolar field of Jupiter at distances of approximately 2 Rj from the center. They also show a displacement of the main dipole of 0.119 plus or minus 0.009 Rj from the center of the disk towards longitude 135-145 degree and a displacement of 0.04 plus or minus 0.04 Rj towards the north in agreement with the displacement found by the Pioneer spacecraft. From the data it is estimated that the thermal disk temperature at this frequency is more than 300 K but less than 340 K, which implies an ammonia mixing ratio of approximately 0.0005. G.Y.

N79-11994*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
AMES COLLABORATIVE STUDY OF COSMIC-RAY NEUTRONS. 2: LOW- AND MID-LATITUDE FLIGHTS
L. D. Stephens, J. B. McCaslin, A. R. Smith, R. H. Thomas, J. E. Hewitt, and L. Hughes 1 Mar. 1978 20 p refs Prepared in cooperation with California Univ., the Lawrence Berkeley Lab.
(Contract W-7405-eng-48)
(NASA-TM-79881; LBL-6738) Avail: NTIS HC A02/MF A01 CSCL 03B

Progress of the study of cosmic ray neutrons is described. Data obtained aboard flights from Hawaii at altitudes of 41,000 and 45,000 feet, and in the range of geomagnetic latitude 17 N less than or equal to lambda less than or equal to 21 N are reported. Preliminary estimates of neutron spectra are made. DOE

N79-11658*# San Francisco Univ., Calif. Dept. of Physics.
HZE-PARTICLE DOSIMETRY Final Report
D. D. Peterson, E. V. Benton, and M. Tran *In* NASA. Ames Res. Center US Expt. Flown on the Soviet Satellite COSMOS 782 Sep. 1978 p 160-178 refs (For primary document see N79-11651 02-51)
(Contract NAS2-7069)
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99 GENERAL

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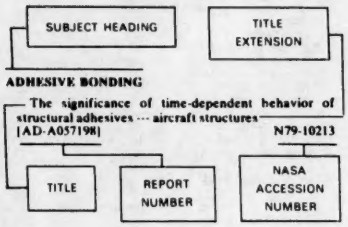

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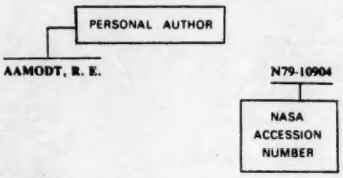

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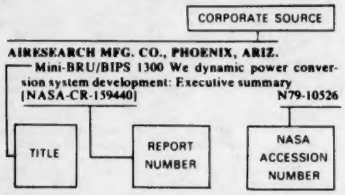

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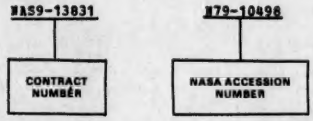

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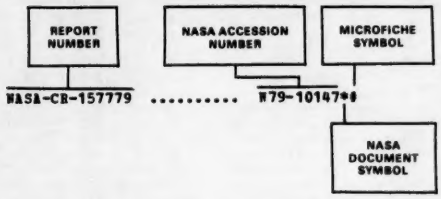

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